ORIGINAL ARTICLE

The role of neutrophil-to-lymphocyte and platelet-to-lymphocyte ratios in predicting the severity of acute biliary pancreatitis

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ABSTRACT

BACKGROUND: Acute biliary pancreatitis (ABP) is an acute inflammation of the pancreas that can vary in severity, potentially leading to life-threatening complications. Early identification of severe cases is crucial for effective management and improved outcomes. Traditional scoring systems, such as the Acute Physiology and Chronic Health Evaluation II (APACHE II) and Ranson, are commonly used to assess severity but can be complex and time-consuming. This study aims to assess the reliability of the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) as accessible biomarkers for predicting ABP severity and to evaluate their relationship with disease severity as determined by the Balthazar grade.

METHODS: This retrospective study analyzed 161 patients diagnosed with acute biliary pancreatitis. Neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio values were compared with ABP severity as assessed by the Balthazar grade. The correlation between these inflammatory biomarkers and disease severity was examined. The study was approved by the Ümraniye Training and Research Hospital Clinical Research Ethics Committee (approval date: 13.03.2025, approval number: 54) and was conducted in accordance with the Declaration of Helsinki.

RESULTS: Elevated NLR and PLR values were significantly associated with increased ABP severity. Both NLR and PLR demonstrated potential as reliable biomarkers for early risk stratification, particularly in resource-limited settings.

CONCLUSION: NLR and PLR may serve as valuable biomarkers in predicting ABP severity, facilitating early clinical decision-making, particularly in settings where advanced imaging is limited. This study also highlights the clinical relevance of these biomarkers within Türkiye, potentially guiding future updates to pancreatitis management protocols.

Keywords: Acute biliary pancreatitis; neutrophil-to-lymphocyte ratio; platelet-to-lymphocyte ratio; Balthazar grade; biomarkers; severity prediction.

INTRODUCTION

Acute pancreatitis (AP) is an inflammatory condition of the pancreas with variable clinical presentations, ranging from mild to severe cases associated with substantial morbidity and mortality. Early identification of severe cases is critical to guide treatment decisions and improve patient outcomes. Severe cases often result in systemic complications such as sepsis and organ failure.[1]

Several scoring systems, including Ranson's criteria, the Acute Physiology and Chronic Health Evaluation II (APACHE II), and the Balthazar classification, are used to assess AP severity.[2]

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However, these systems are limited by their complexity, need for serial assessments, and reliance on advanced imaging. The Balthazar score was preferred in our study, as it provides an objective radiological assessment of pancreatic and peripancreatic involvement and has been shown to correlate with clinical severity. Thus, identifying simple, accessible, and cost-effective biomarkers for early severity prediction has gained clinical significance.

Inflammatory markers such as C-reactive protein (CRP) are widely used to monitor the severity of acute pancreatitis. Başak et al.[3] demonstrated that combining CRP with Ranson's score improves the accuracy of severity prediction. Additionally, D-dimer, a fibrin degradation product, has been associated with disease severity in both hyperlipidemic and biliary acute pancreatitis.[4,5] Elevated D-dimer levels reflect increased fibrin turnover and are linked to more severe disease.

Recently, the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) have gained attention as simple, cost-effective markers of systemic inflammation. Due to their wide availability and low cost, these indices are particularly valuable for early risk stratification in acute pancreatitis.[6-8]

This study aimed to evaluate the reliability of NLR and PLR in predicting the severity of acute biliary pancreatitis (ABP) and to investigate their relationship with Balthazar grades, potentially optimizing early clinical management.

MATERIALS AND METHODS

Study Design and Population

This retrospective study included 161 patients diagnosed with acute biliary pancreatitis who were admitted to our hospital between 2015 and 2024. Patients were identified using electronic medical records. The study was approved by the Ümraniye Training and Research Hospital Clinical Research Ethics Committee (approval date: 13.03.2025, approval number: 54). All procedures were conducted in accordance with the principles of the Declaration of Helsinki.

Data Collection

Demographic data, CRP levels, neutrophil, lymphocyte, and platelet counts, as well as NLR and PLR values at admission and at 48 hours, were recorded. Laboratory data from complete blood count tests were analyzed.

Formulas used:

- NLR=Neutrophil count / Lymphocyte count
- PLR=Platelet count / Lymphocyte count

Radiological assessment was performed using contrast-enhanced computed tomography (CT) scans within 48 hours of admission, and disease severity was classified according to the Balthazar grade. Imaging was interpreted by an experienced abdominal radiologist.

Balthazar Grading:

- A: Normal pancreas
- B: Pancreatic enlargement
- C: Inflammatory changes in the pancreas and peripancreatic fat
- D: Single ill-defined fluid collection
- E: Two or more poorly defined fluid collections or pancreatic necrosis

Statistical Analysis

The Kruskal-Wallis test and One-Way Analysis of Variance (ANOVA) were used for group comparisons. The Pearson chi-square test was used for categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

Demographic Data

There was no significant difference in mean age between groups (p=0.797), and gender distribution was similar and not statistically significant (p=0.770) (Table 1).

Admission Data

At admission, CRP levels showed significant differences according to Balthazar grade (p=0.010), with higher levels observed in the Balthazar C and D groups. Neutrophil counts were significantly different (p=0.000), peaking in Balthazar E. Lymphocyte counts also differed significantly (p=0.036), with the lowest values in the Balthazar A and E groups. No significant difference was observed in platelet counts (p=0.225). Admission NLR values differed significantly (p=0.002), with the highest values in Balthazar E. PLR values also differed significantly (p=0.044), with the highest value in Balthazar E (238.6) (Table 2, Figs. 1 and 2).

Table 1. Demographic data comparison

Parameter	Balthazar 0	Balthazar 1	Balthazar 2	Balthazar 3	Balthazar 4	p-value
Age (mean±SD)	2.511±3.079	2.576±4.715	3.697±4.715	4.715±3.697	3.079±3.697	0.797
Gender (M/F)	0.575	0.555	0.655	0.555	1.111	0.770535

(M: Male; F: Female; SD: Standard deviation.)

Table 2. Statistical analysis of admission and 48-hour data according to Balthazar classification

Parameter	Balthazar 0	Balthazar 1	Balthazar 2	Balthazar 3	Balthazar 4	Chi-Square/ p-value
Admission CRP (mg/L)	2.3 (6)	7.15 (13)	7.8 (17)	5.15 (12)	7.5 (9)	13.297/0.010
Admission Neutrophil Count (×10³/μL)	7.3 (2.8)	8.7 (4.175)	10 (7.425)	9.55 (4.2)	13.2 (5.2)	30.161/0.000
Admission Lymphocyte Count (×10³/μL)	1.4 (1)	1.3 (0.95)	1.7 (1.15)	1.95 (1.1)	1.3 (0.6)	10.299/0.036
Admission Platelet Count (×10³/μL)	253 (96)	270 (110.3)	280 (135.5)	252.5 (96.5)	275 (104)	5.673/0.225
Admission Neutrophil-to-Lymphocyte Ratio (NLR)	5.1 (4.5)	5.3 (8.1)	6.9 (9.5)	4.75 (3.3)	12.1 (10.4)	16.712/0.002
Admission Platelet-to-Lymphocyte Ratio (PLR)	178 (85)	201.4 (156.8)	185.45 (150.7)	134.3 (90.2)	238.6 (233.9)	9.798/0.044
48-Hour CRP (mg/L)	5.3 (12.6)	35.75 (86.7)	48.85 (132.2)	29.45 (122.3)	32.2 (222.6)	40.224/0.000
48-Hour Neutrophil Count (×10³/μL)	4.8 (3.7)	5.3 (4.4)	8.6 (7.7)	6.85 (4.4)	12.5 (10.4)	34.204/0.000
48-Hour Lymphocyte Count (×10³/μL)	1.7 (1.1)	1.6 (1)	1.6 (1.3)	1.65 (0.7)	1.2 (0.7)	4.390/0.356
48-Hour Platelet Count (×10³/μL)	218 (111)	228.5 (100)	212.5 (92.8)	217 (84.5)	239 (156)	3.133/0.536
48-Hour Neutrophil-to-Lymphocyte Ratio (NLR)	3 (2.9)	3.3 (4.5)	4.9 (6.2)	4.15 (4.4)	9.7 (8.8)	30.314/0.000
48-Hour Platelet-to-Lymphocyte Ratio (PLR)	128.1 (54.9)	137.45 (66.4)	123.15 (104.9)	127 (54.9)	166.9 (169)	4.057/0.398

(CRP: C-reactive protein; NLR: Neutrophil-to-lymphocyte ratio; PLR: Platelet-to-lymphocyte ratio; SD: Standard deviation; ×10³/μL: Thousands per microliter.)

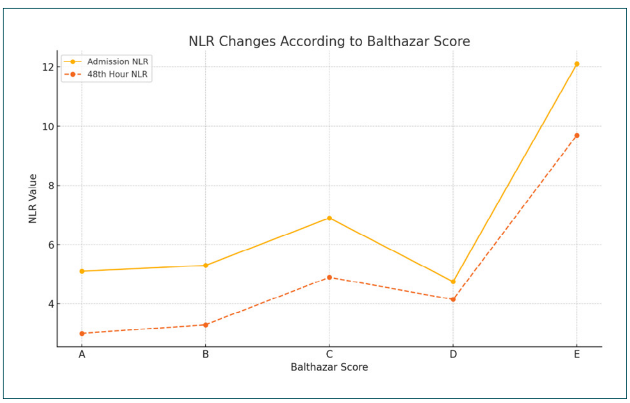

Figure 1. Changes in neutrophil-to-lymphocyte ratio (NLR) according to Balthazar score. *(NLR: Neutrophil-to-lymphocyte ratio.)*

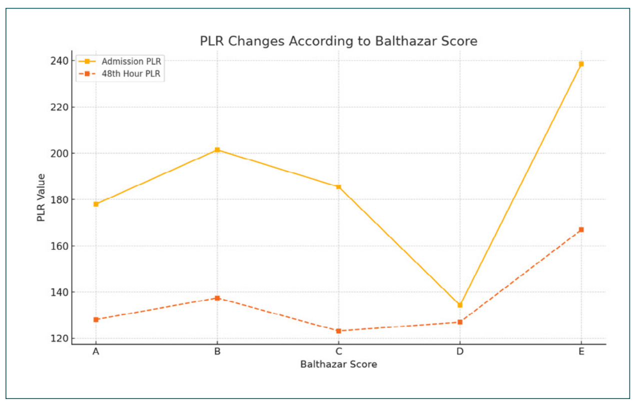

Figure 2. Changes in platelet-to-lymphocyte ratio (PLR) according to Balthazar score. *(PLR: Platelet-to-lymphocyte ratio.)*

48-Hour Data

C-reactive protein levels continued to differ significantly across groups at 48 hours (p=0.000), with the highest levels in the Balthazar C and D groups. Neutrophil counts remained significantly different (p=0.000), again peaking in Balthazar E. Lymphocyte and platelet counts showed no significant differences at 48 hours (p=0.356 and p=0.536, respectively). NLR values differed significantly at 48 hours (p=0.000), with the highest values again observed in Balthazar E. PLR values did not differ significantly at 48 hours (p=0.398) (Table 2, Figs. 1 and 2).

Overall Evaluation

Significant differences were observed in CRP, neutrophil count, NLR, and PLR at both admission and at 48 hours, with particularly elevated values in Balthazar E. No significant differences were noted for lymphocyte or platelet counts. These findings support the predictive value of laboratory markers such as NLR and PLR in assessing the severity of acute biliary pancreatitis.

DISCUSSION

Acute biliary pancreatitis is a potentially life-threatening condition requiring timely diagnosis and management. Imaging-based scoring systems, such as the Balthazar CT Severity Index, are reliable but resource-intensive.[9,10] Therefore, simpler biomarkers like NLR and PLR represent attractive alternatives.

Traditional scoring systems such as Ranson's criteria, APACHE II, and the Bedside Index for Severity in Acute Pancreatitis

(BISAP) require multiple clinical and laboratory parameters, repeated measurements, and, in some cases, advanced imaging, making them time-consuming and less practical in acute settings.[11,12] Although simpler laboratory markers such as C-reactive protein and hematocrit have been studied, their predictive value is limited. For example, CRP levels typically peak 48–72 hours after symptom onset, reducing their utility for very early risk assessment, while hematocrit can be influenced by hydration status and other comorbid conditions.[13] These limitations underline the need for easily accessible, inexpensive, and rapidly measurable markers that can aid in the early stratification of acute biliary pancreatitis severity.

Our findings demonstrate that higher NLR and PLR values are associated with increased ABP severity. Elevated inflammatory parameters corresponded with greater pancreatic and peripancreatic involvement. These results align with previous studies supporting NLR and PLR as markers of systemic inflammation.[14-16]

Advantages of NLR and PLR include cost-effectiveness, wide availability, and the ability to monitor disease progression dynamically. However, limitations include the retrospective design and reliance on imaging for Balthazar grading.[9,17] The routine use of NLR and PLR could facilitate early risk stratification and support timely management decisions in patients with acute biliary pancreatitis, particularly in resource-limited settings.

CONCLUSION

This study highlights the potential role of NLR and PLR as simple, accessible biomarkers for the early prediction of ABP severity. Their routine use could enhance clinical decision-making, especially in settings with limited imaging resources. Further large-scale validation is necessary to fully integrate these markers into clinical practice.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Akut biliyer pankreatit şiddetinin öngörülmesinde Nötrofil/Lenfosit ve Platelet/Lenfosit oranlarının rolü

AMAÇ: Akut biliyer pankreatit (ABP), pankreasın şiddeti değişkenlik gösterebilen akut inflamasyonudur ve potansiyel olarak yaşamı tehdit eden komplikasyonlara yol açabilir. Şiddetli vakaların erken tanımlanması, etkili yönetim ve daha iyi hasta sonuçları için kritik öneme sahiptir. APACHE II ve Ranson gibi geleneksel skorlama sistemleri hastalığın şiddetini değerlendirmede yaygın olarak kullanılmaktadır; ancak bu sistemler karmaşık ve zaman alıcı olabilir. Bu çalışma, nötrofil-lenfosit oranı (NLR) ve platelet-lenfosit oranının (PLR), ABP şiddetini öngörmede erişilebilir biyobelirteçler olarak güvenilirliğini değerlendirmeyi ve bu oranların Balthazar derecesi ile belirlenen hastalık şiddetiyle ilişkisini incelemeyi amaçlamaktadır.

GEREÇ VE YÖNTEM: Bu retrospektif çalışmada, akut biliyer pankreatit (ABP) tanısı alan 161 hasta incelendi. Nötrofil/lenfosit oranı (NLR) ve platelet/lenfosit oranı (PLR) değerleri, Balthazar derecesiyle değerlendirilen ABP şiddeti ile karşılaştırıldı. Bu inflamatuar biyobelirteçler ile hastalık şiddeti arasındaki korelasyon araştırıldı. Çalışma, Ümraniye Eğitim ve Araştırma Hastanesi Klinik Araştırmalar Etik Kurulu tarafından onaylanmış olup (onay tarihi: 13.03.2025, onay numarası: 54), Helsinki Deklarasyonu'na uygun olarak yürütülmüştür.

BULGULAR: Yüksek NLR ve PLR değerleri, artmış ABP şiddeti ile anlamlı şekilde ilişkili bulunmuştur. NLR ve PLR'nin her ikisi de özellikle kaynakların sınırlı olduğu ortamlarda erken risk sınıflandırmasında güvenilir biyobelirteçler olarak potansiyel göstermiştir.

SONUÇ: NLR ve PLR, ABP şiddetinin öngörülmesinde değerli biyobelirteçler olarak işlev görebilir ve özellikle ileri görüntüleme yöntemlerinin sınırlı olduğu durumlarda erken klinik karar verme sürecini kolaylaştırabilir. Bu çalışma, aynı zamanda bu biyobelirteçlerin Türkiye'deki klinik uygulamadaki önemine dikkat çekmekte ve pankreatit yönetim protokollerinin gelecekteki güncellemeleri için yol gösterici olabilir.

Anahtar sözcükler: Akut biliyer pankreatit; Balthazar derecesi; biyobelirteçler; nötrofil/lenfosit oranı; platelet/lenfosit oranı; şiddet öngörüsü.

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