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Evaluation of the Between Systemic Inflammatory Markers and Disease Severity in Geriatric Acute Pancreatitis Patients in the Emergency Medicine

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Abstract

Background/aim: Acute pancreatitis tends to have a more severe course in geriatric patients. Early recognition of disease severity in this population may help reduce morbidity and mortality. This study aimed to retrospectively evaluate the predictive value of systemic inflammatory markers in determining disease severity in patients diagnosed with geriatric acute pancreatitis.

Materials and Methods: This was a retrospective, single-center study. Patients aged 65 years and older who presented to the Emergency Medicine Clinic of Ankara Atatürk Sanatorium Training and Research Hospital between January 1, 2017, and November 1, 2022, and were diagnosed with acute pancreatitis were included in the study. Demographic data, comorbidities, vital signs, systemic inflammatory markers, and imaging results were obtained retrospectively. Patients diagnosed with acute pancreatitis and its subcodes based on International Classification of Disease 10 (ICD) codes were considered to have pancreatitis. Disease severity was assessed using the Ranson score, with scores of 0–3 classified as mild pancreatitis and scores of 4–11 classified as severe pancreatitis.

Results: Of the 106 patients included in the study, 67% were female, and the median age was 74 years (range: 66–82). Severe pancreatitis was observed in 19.8% of the patients. Compared to the mild pancreatitis group, the severe pancreatitis group had significantly higher white blood cell (WBC) counts, neutrophil counts, neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and intensive care unit (ICU) admission rates ($p < 0.05$ for all values).

Conclusion: Patients with severe acute pancreatitis, as classified by the Ranson scoring system, had significantly higher WBC, NLR, and PLR values compared to those with mild pancreatitis. All these parameters were found to be associated with disease severity. Because NLR and PLR are easily accessible and simple to calculate in emergency departments, they may be considered useful parameters in determining disease severity in acute pancreatitis patients.

Keywords

Geriatric, acute pancreatitis, systemic inflammatory markers, neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), Ranson score

Introduction

Acute pancreatitis is a disease characterized by inflammation of the pancreatic parenchyma and has a multifactorial etiology. With the increasing life expectancy in the 21st century, the global population has aged significantly. Acute pancreatitis is a common reason for emergency department visits, with approximately 30% of cases occurring in elderly patients [1]. Severe acute pancreatitis is associated with a mortality rate of 8–10%, while in elderly patients, this rate can rise to 20–25% [2].

Elderly patients with acute pancreatitis often present with atypical clinical features and have a worse prognosis in severe cases. The more severe course in geriatric patients is attributed to factors such as decreased organ functional reserve, comorbidities, reduced ability to tolerate fluid shifts, ischemia, and infections [2,3].

The APACHE II and Ranson criteria are clinical scoring systems used to predict disease severity (4). The pathophysiology of acute pancreatitis is characterized by the autodigestion of pancreatic tissue by its own enzymes, triggering an inflammatory response [5].

Cytokines, chemokines, and other inflammatory mediators play a significant role in this process [6]. While mild acute pancreatitis cases usually resolve spontaneously, severe cases are associated with high morbidity and mortality rates [7].

The pancreatic tissue begins to shrink after the age of 60 due to aging-related changes. Over time, fibrosis and atrophy develop due to decreased blood supply, and pancreatic ducts become dilated. Additionally, exocrine pancreatic functions decline [8]. When the mortality of the geriatric population is compared to that of the younger population based on the Ranson criteria, the mortality rate is found to be higher in geriatric patients [9].

The neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) are important inflammatory markers derived from complete blood count tests. NLR, which represents the ratio of neutrophils to lymphocytes, has been shown to serve as an indicator of inflammatory response. Elevated NLR levels have been associated with disease severity in inflammatory gastrointestinal pathologies such as choledocholithiasis and pancreatitis. Studies have demonstrated that higher NLR levels in acute pancreatitis patients of all age groups correlate with a more severe disease course and an increased risk of complications [10-12]. Similarly, PLR, which represents the ratio of platelets to lymphocytes, reflects systemic inflammatory response and pro-thrombotic conditions. Elevated PLR levels in acute pancreatitis have been suggested to be associated with inflammation, thrombosis risk, and poor prognosis [13]. These biomarkers are considered useful in the management of inflammatory diseases such as cholecystitis and pancreatitis.

Although age is included as a risk factor in many clinical prognostic scoring systems for assessing acute pancreatitis severity, these criteria are not specific to elderly patients. As the population continues to age, the number of geriatric patients presenting with acute pancreatitis is expected to increase. Studies have shown that the incidence of severe pancreatitis rises with age. Early identification of high-risk elderly patients is crucial. High-risk patients may require prolonged hospitalization, early resuscitation, close monitoring, and admission to the intensive care unit, whereas low-risk patients may be discharged earlier.

In this study, we aimed to evaluate systemic inflammatory blood parameters obtained from complete blood count tests in geriatric patients diagnosed with acute pancreatitis in the emergency department and to investigate the relationship between these parameters and disease severity.

Materials and Methods

Study design and participants

This study is a retrospective, single-center study. Patients aged 65 years and older who presented to the Emergency Medicine Clinic of Ankara Atatürk Sanatorium Training and Research Hospital between 01.01.2017 and 01.11.2022 and had an ICD code (K85, K85.0, K85.1, K85.8, K85.9) for acute pancreatitis were included in the study. Ethical approval for this study was obtained from Atatürk Sanatoryum Training and Research Hospital Ethics Committee (2012-KAEK-15/2845, 13.12.2023). Patients with missing data or repeated admissions, patients with acute chronic infections, chronic inflammatory conditions, hematological and myeloproliferative oncological diseases and Patients with missing laboratory tests were excluded from the study.

Data collection

Demographic data, comorbidities, vital signs, laboratory and imaging findings, and hospital outcomes (discharge, ward admission, intensive care unit admission, transfer, in-hospital mortality) were retrospectively obtained from the hospital automation system and patient records. All data were recorded in a pre-prepared data collection form.

The severity of acute pancreatitis was assessed according to the Ranson score. Laboratory parameters at the time of admission were used to calculate the Ranson score. Based on the Ranson score, pancreatitis severity was classified as mild (score 0–3) and severe (score 4–11) [14].

Calculation of NLR and PLR

NLR and PLR were calculated from the first complete blood count obtained at admission by dividing the neutrophil count by the lymphocyte count and the platelet count by the lymphocyte count, respectively.

Blood Sample Analysis

Blood samples taken within the first hour of hospital admission were analyzed. Complete blood count parameters were measured using the Mindray BC6800 analyzer (China), biochemical parameters were analyzed using the Beckman Coulter AU5800 and AU680 analyzers (China), and blood gas parameters were measured using the Siemens Rapidlab 1285 analyzer.

Statistical Analysis

Analysis of study data was performed using the IBM SPSS 20.0 (Chicago, IL, USA) statistical program. The Kolmogorov-Smirnov test was used to determine whether discrete and continuous numerical data followed a normal distribution. Continuous numerical variables were expressed as median (IQR 25-75), and categorical variables were presented as numbers and percentages (%).

Categorical variables were analyzed using the Chi-square and Fisher's exact tests, while continuous variables were analyzed using the Mann-Whitney U test.

A p-value of <0.05 was considered statistically significant. A receiver-operating characteristic (ROC) analysis was performed, and the area under the curve (AUC) was calculated to determine the cutoff levels of NLR and PLR for predicting the severity of acute pancreatitis.

Results

A total of 134 patients were initially considered for the study. However, 28 patients with missing data were excluded, leaving 106 patients for final analysis. The majority of the patients were female (67%), and the median age was 74 years (66–82). Severe pancreatitis was observed in 19.8% of the patients **(Table 1).**

Table 1: Demographic data of all patients

Female Gender, n (%)	71 (67%)
Age, median (IQR 25-75)	74 (66-82)
Comorbid diseases, n (%)	
▪ Hypertension	42 (39.6%)
▪ Diabetes	14 (13.2%)
▪ CAD	10 (9.6%)
▪ Other	20 (18.9%)
Vital signs, median (IQR 25-75)	
▪ Systolic blood pressure	132.5 (105-160)
▪ Diastolic blood pressure	80 (60-95)
▪ Pulse	95 (75-115)
▪ Temperature	37 (36.6-37.5)
Tomography findings, n (%)	
▪ Edematous pancreatitis	15 (14.2%)
▪ Necrotizing pancreatitis	4 (.8%3)
▪ Abscess	3 2.8(%)
▪ Choledochal pathology	35 (33%)
Laboratory, median (IQR 25-75)	
▪ Glucose	152 (125.7-228)
▪ AST	100.5 (38.5-250.5)
▪ ALT	59.5 (22-154)
▪ ALP	100.5 (79.5-130)
▪ GGT	99.5 (38-195.2)
▪ Amylase	988.5 (354-1567)
▪ Lipase	1883.5 (812.5-3893)
▪ Creatinine	0.965 (0.81-1.24)
▪ Calcium	9.3 (9-9.7)
▪ Albumin	3.8 (3.4-4.1)
▪ CRP	52.215 (26-127)
Complete blood count, median (IQR 25-75)	
▪ WBC	12.7 (9.7-18)
▪ Neutrophil	9.955 (6.94-16.51)
▪ Lymphocyte	1.48 (0.93-2.1)
▪ Hematocrit	41.7 (38.6-44.9)
▪ Platelet	234 (177.5-278.5)
▪ NLR	6.4283 (4.13-14.19)
▪ PLR	152.8282 (101.2-242.6)
Pancreatitis severity n (%)	
▪ Moderate-Severe	21 (19.8%)
▪ Mild	85 (80.2%)
Outcome n (%)	
▪ Admission to service	101 (95.3%)
▪ Admission to intensive care unit	5 (4.7%)
Hospital duration, days, median (IQR 25-75)	4 (2-6)

CAD: Coronary artery disease, *AST:* Aspartate Aminotransferase, *ALT:* Alanine Aminotransferase, *ALP:* Alkaline Phosphatase, *GGT:* Gamma-Glutamyl Transferase, *CRP*: C reactive protein, *WBC*: White blood cell, *NLR*: Neutrophil lymphocyte ratio, *PLR:* Platelet lymphocyte ratio

In the severe pancreatitis group, lymphocyte levels were lower, whereas glucose, C-reactive protein (CRP), white blood cell (WBC) count, neutrophil count, NLR, and PLR were significantly higher compared to the mild pancreatitis group. Additionally, the intensive care unit (ICU) admission rate was significantly higher in the severe pancreatitis group ($p < 0.05$) **(Table 2).**

In the ROC analysis conducted to determine the cutoff values for NLR and PLR in predicting pancreatitis severity, the area under the curve (AUC) for NLR was 0.823 (95% CI: 0.744–0.902, $p < 0.001$), while the AUC for PLR was 0.685 (95% CI: 0.539–0.831, $p = 0.009$) **(Figure 1).**

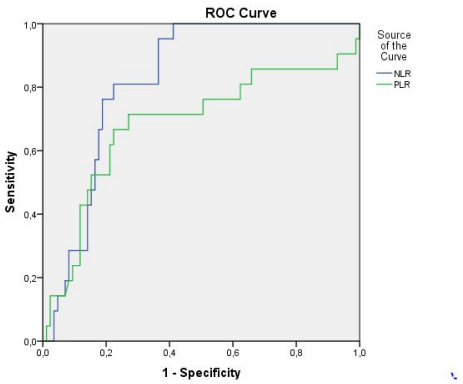

Figure 1: ROC Analysis for NLR and PLR

Discussion

In this study evaluating the correlation between systemic inflammatory markers and disease severity in geriatric acute pancreatitis patients, we found that NLR, PLR, WBC, and neutrophil levels were significantly higher in the severe acute pancreatitis group compared to the mild group. The low cost, rapid accessibility, and clinical significance of these markers in predicting patient prognosis suggest their suitability for use in the geriatric population.

Geriatric patients have higher morbidity and mortality rates compared to younger patients due to weakened immune systems, age-related physiological changes, and chronic diseases, leading to a more severe course of the disease. Therefore, determining disease severity and developing appropriate treatment strategies are more critical in the geriatric population. Increased mortality in geriatric pancreatitis patients is often associated with comorbid conditions. When assessing these patients, comorbidities should be taken into account. In a study by Bath et al., it was suggested that Ranson's criteria might be insufficient in predicting mortality in elderly patients due to existing comorbidities [15].

Table 2: Comparison of patient characteristics and laboratory values according to pancreatitis severity

	Mild	Severe	p value
Female Gender, n (%)	57 (67.1%)	14 (66.7½)	0.973
Age, median (IQR 25-75)	73 (66-81)	79 (69-84)	0.125
Comorbid diseases, n (%)			
▪ Hypertension	32 (37.6%)	10 (47.6%)	0.403
▪ Diabetes	11 (12.9%)	3 (14.3%)	0.556
▪ CAD	7 (8.2%)	3 (14.3%)	0.308
Vital signs, median (IQR 25-75)			
▪ Systolic blood pressure	135 (105-162.5)	125 (104.5-155)	0.531
▪ Diastolic blood pressure	80 (60-95)	80 (60-97.5)	0.994
▪ Pulse	95 (80-115)	86 (72.5-115)	0.326
▪ Temperature	37 (36.6-37.4)	37 (36.5-37.7)	0.711
Laboratory, median (IQR 25-75)			
▪ Glucose	140 (118.5-158)	252 (234.5-306)	<0.001
▪ AST	99 (36.5-207)	134 (40-330.5)	0.316
▪ ALT	59 (22-132)	83 (17-226)	0.698
▪ ALP	98 (77-128.5)	116 (89.5-155.5)	0.119
▪ GGT	95 (39-185)	155 (27.5-270)	0.316
▪ Amylase	975 (369.5-1511.5)	1014 (234-1941)	0.997
▪ Lipase	2015 (803-3908.5)	1858 (765-4382)	0.846
▪ Creatinine	0.95 (0.805-1.19)	1.06 (0.85-1.38)	0.140
▪ Calcium	9.3 (9-9.7)	9.5 (9-9.95)	0.172
▪ Albumin	3.8 (3.4-4.1)	4 (3.4-4.2)	0.656
▪ CRP	47.7 (26.8-107.9)	132 (36.1-169.6)	0.020
▪ WBC	10.8 (9.15-14.9)	19.2 (18-21.1)	<0.001
▪ Neutrophil	8.83 (6.48-12.37)	17.7 (16.7-18.4)	<0.001
▪ Lymphocyte	1.53 (0.995-2.265)	1.05(0.81-1.51)	0.021
▪ Hematocrit	41.8 (38.4-44.6)	41 (39.5-45.2)	0.560
▪ Platelet	233 (172-275.5)	247 (195-318)	0.283
▪ NLR	5.5 (3.5-10.9)	14.7 (12.6-21.4)	<0.001
▪ PLR	147.9 (99.4-188.8)	255.1 (136-364.6)	0.009
Outcome n (%)			
▪ Admission to service	85 (100%)	16 (77.2%)	<0.001
▪ Admission to intensive care unit	0 (0%)	5 (23.8%)	
Hospital duration, days, median (IQR 25-75)	4 (2-5)	5 (2-7.5)	0.103

CAD: Coronary artery disease, *AST:* Aspartate Aminotransferase, *ALT:* Alanine Aminotransferase, *ALP:* Alkaline Phosphatase, *GGT:* Gamma-Glutamyl Transferase, *CRP*: C reactive protein, *WBC*: White blood cell, *NLR*: Neutrophil lymphocyte ratio, *PLR:* Platelet lymphocyte ratio

NLR is considered a parameter that reflects both neutrophil elevations, indicating an acute inflammatory response, and lymphocyte reduction, which is associated with poor general health status and physiological stress [16]. In our study, NLR levels were found to be significantly higher in severe acute pancreatitis patients. NLR is determined by the increase in neutrophils during an inflammatory response and the decrease in lymphocytes due to immune suppression.

The literature also supports the use of NLR as an indicator of inflammatory response, with high NLR levels being associated with disease severity and poor prognosis [17]. Additionally, a study by Jeon et al. involving 490 patients found that NLR had a high predictive value for acute pancreatitis severity. In patients over 18 years old with pancreatitis, an NLR value >18.71 at emergency department admission was found to predict mortality with 80% sensitivity and 90.2% specificity. Similarly, in a 2022 study by Halaseh et al. involving 314 patients, NLR was reported to have an 80% sensitivity and 90% specificity, further supporting its high predictive value for pancreatitis severity [18]. Elevated NLR levels indicate a severe inflammatory response and immune suppression in acute pancreatitis patients. Our study, conducted on geriatric patients, yielded similar findings to those reported in the literature.

In our study, PLR levels were also found to be elevated in severe acute pancreatitis patients. In the literature, PLR is recognized as an important parameter reflecting thrombotic activity and inflammation. In a study by Vo et al. involving 131 patients, the cutoff value for PLR in predicting acute pancreatitis mortality was determined to be >202.7, with an AUC of 0.72 (95% CI: 0.60–0.84), a sensitivity of 66.7%, and a specificity of 71.8% [19]. Additionally, a study by Kong et al. in 2020 demonstrated that PLR is a significant prognostic marker in acute pancreatitis patients [20]. Elevated PLR levels indicate increased thrombotic activity and inflammatory response. The high PLR levels observed in our study were consistent with findings in the literature.

Our study has some limitations. First, as a single-center study, its findings cannot be generalized to other centers. Second, due to the retrospective nature of the study, incomplete and inaccurate data in hospital records may have affected the study results. The small number of patients is another limitation.

Conclusion

As in all age groups, NLR and PLR values emerge as important parameters in geriatric acute pancreatitis patients. Our study found that these inflammatory markers were significantly higher in severe geriatric acute pancreatitis cases.

In conclusion, systemic inflammatory markers were shown to be effective in determining disease severity in geriatric acute pancreatitis patients. These markers may help clinicians rapidly and accurately assess disease severity. Regular monitoring and evaluation of inflammatory markers such as NLR and PLR may play a crucial role in the management and treatment of geriatric acute pancreatitis patients.

Author contribution statement

All authors (MKÜ, EE, HÖO, YÇ) participated in the planning, writing, editing, and review of this manuscript.

Conflicts of interest

None Declared.

Ethical approval

Ethical approval for this study was obtained from Atatürk Sanatoryum Training and Research Hospital Ethics Committee (2012-KAEK-15/2845, 13.12.2023)

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