RESEARCH ARTICLE

Correlation between neutrophil/lymphocyte ratio and Ranson score in acute pancreatitis

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Background: Acute pancreatitis (AP) is characterized by inflammation of the pancreas, elevated pancreatic enzymes, and abdominal pain. The neutrophil to lymphocyte ratio (NLR) is used as a marker of inflammation. In this retrospective study, we aimed to investigate novel early prognostic predictors of AP, such as NLR and its correlation with the Ranson score.

Methods: A total 435 patients (Male: 152; 34.9%, Age: 63.53 ± 17.22 years) were included in the study. Data were collected by two clinicians scanning the registered hospital records.

Results: Classification of the patients according to the aetiologies revealed gallstone(s) 58.6% ($n = 255$), hyperlipidaemia 2.2% ($n = 9$), viruses 0.7% ($n = 3$), malignancies 0.5% ($n = 2$), and alcohol 0.2% ($n = 1$). No reason was discovered in 37.9% ($n = 165$) of patients. Age, duration in the intensive care unit, serum aspartate aminotransferase (AST) levels, alanine aminotransferase (ALT), alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT), total bilirubin, direct bilirubin, lactate dehydrogenase (LDH), white blood cell (WBC) count, neutrophil count, lymphocyte count, and the NLR were greater in the group with a Ranson score ≥ 3 than the group with a Ranson score < 3 .

Discussion: Quick diagnosis is essential in AP. Current scoring systems for AP diagnosis are complicated, whereas NLP is a simple, practical, and effective marker.

KEYWORDS

acute pancreatitis, neutrophil to lymphocyte ratio, Ranson score

1 | INTRODUCTION

AP is characterized by acute inflammation of the pancreas in patients with upper abdominal pain. Biochemical or radiologic proof is required for AP diagnosis. AP may present as simple abdominal pain (relieved by clinical fluid replacement), nausea, or vomiting. In addition, AP symptoms can include systemic inflammatory response syndrome (SIRS), organ failure (OF), persistent organ failure (POF), and ultimately death. To date, many parameters and scoring systems anticipating the clinical course of AP have been used. The neutrophil to lymphocyte ratio is an easily calculated, systemic inflammation-based parameter. The NLR correlation with inflammatory, neoplastic, and cardiovascular diseases has been evaluated in various

studies. In a number of studies, NLR has been suggested as a marker of AP prognosis. However, there are a limited number of studies investigating the correlation between NLR and the Ranson score in the literature.¹⁻⁵

In this retrospective study, we investigated novel early prognostic predictors of AP and their correlation with the Ranson score.

2 | MATERIALS AND METHODS

2.1 | Study population

In this retrospective study, we analyzed data of 602 patients with an AP diagnosis, who stayed at our clinic between January 2014 and

December 2016. The study conformed to the ethical guidelines of the 1975 Declaration of Helsinki.

AP diagnosis was established by the presence of 2 of 3 criteria below:

1. Abdominal pain consistent with AP,
2. Serum amylase and/or lipase elevation ≥ 3 times the upper limit of normal
3. Contrast-enhanced computed tomography, magnetic resonance imaging, or abdominal ultrasonography findings consistent with AP.

The study involved a total of 435 patients. Exclusion criteria were abdominal pain beginning 72 hours before the hospital visit ($n = 64$), younger than 18 years of age ($n = 23$), pancreatitis developed as a result of trauma ($n = 22$), pancreatitis developed during pregnancy ($n = 14$) and insufficient hemogram, biochemical parameters, and file data ($n = 108$). Data were collected by two clinicians scanning the registered hospital records.

2.2 | Statistical analyses

Descriptive statistics are presented as mean, standard deviation, and percentages. Pearson's correlation coefficient was calculated for relationships between all quantitative variables. Spearman's correlation coefficient was calculated for relationships between ordinal and quantitative variables. The Mann-Whitney U test was used to compare quantitative variables between two groups with heterogeneous sample sizes. A binary logistic regression model with backward stepwise elimination method was used as a multivariate approach. The Statistical Package for Social Sciences version 15.0 (SPSS Inc., Chicago, IL, USA) statistical software was used for analyses. Statistical significance was accepted at 0.05.

3 | RESULTS

Baseline characteristics of 435 patients included in the study (Male: 152; 34.9%, Age: 63.53 ± 17.22 years) are presented in Table 1. Classification of the patients according to the etiologies revealed gallstone(s) 58.6% ($n = 255$), hyperlipidaemia 2.2% ($n = 9$), viruses 0.7% ($n = 3$), malignancies 0.5% ($n = 2$), and alcohol 0.2% ($n = 1$). No reason was discovered in 37.9% ($n = 165$) of patients. Endoscopic retrograde cholangiopancreatography (ERCP) was performed on 29.3% ($n = 127$) of patients due to gallstones.

The classification of acute pancreatitis by etiology is presented in Table 2.

When the patients were classified by Ranson score within the first 24 hours, 139 (32%) scored 0, 142 (32.6%) scored 1, 102 (23.2%) scored 2, 40 (9.2%) scored 3, 12 (2.8%) scored 4, and 1 (0.2%) scored 5 points. We compared patients with a Ranson score < 3 to patients with a Ranson score ≥ 3 . In the Ranson score ≥ 3 group, age, duration in intensive care, serum glucose, AST, ALT, ALP, and GGT levels, total

TABLE 1 Baseline characteristics of the patients with acute pancreatitis

	Mean	SD
Age (Years)	63.53	17.22
Gender (Male,%)	34.9	
Service stay (Day)	2.06	0.39
ICU stay (Day)	3.20	1.24
Total hospital stay (Day)	5.23	1.37
Laboratory Data		
Glucose (ng/dL)	136.46	72.57
Ürea (mg/dL)	31.87	22.32
Creatine (mg/dL)	1.23	8.55
AST (U/L)	170.61	206.38
ALT (U/L)	181.35	177.08
ALP (U/L)	178.22	163.27
GGT (IU/L)	287.78	317.12
Albumine (g/dL)	5.32	21.55
Total bilirubin (mg/dL)	2.20	3.92
Direct bilirubin (mg/dL)	1.37	2.00
Amylase (U/L)	813.64	702.13
LDH (U/L)	290.16	146.36
Total cholesterol (mg/dL)	180.47	55.68
Triglyceride (mg/dL)	122.20	147.41
HDL (mg/dL)	49.19	26.26
LDL (mg/dL)	117.95	125.80
Ca (mg/dL)	9.32	5.20
CRP (mg/L)	7.75	11.83
Erythrocyte sedimentation rate (mm/h)	19.40	17.04
White blood cell ($10^9/L$)	12.75	13.54
Neutrophile ($10^9/L$)	9.69	5.99
Lymphocyte ($10^9/L$)	1.46	0.70
Neutrophile/lymphocyte ratio	9.51	10.29
Hemoglobine (g/dL)	13.24	7.17
Hematocrit (%)	37.58	5.18
Platelets ($10^9/L$)	246.08	79.49
RDW (%)	14.84	2.07
Red blood cell ($10^9/L$)	4.65	2.09
TSH (mIU/L)	1.94	3.11
FT4 (pmol/L)	1.22	0.30

ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransferase; Ca, calcium; CRP, C reactive protein; FT4, free thyroxine; GGT, gamma-glutamyl transferase; HDL, high density lipoprotein; ICU, intensive care unit; LDH, lactate dehydrogenase; LDL, low density lipoprotein; RDW, red cell distribution width; TSH, thyroid-stimulating hormone.

bilirubin, direct bilirubin, LDH, WBC, leukocyte count, lymphocyte count, and NLR were greater than the group with Ranson score < 3 . The difference between groups was statistically significant (Table 3).

TABLE 2 Classification of acute pancreatitis by etiology

	N (%)
Bile stones	255 (58.6%)
Hyperlipidemia	9 (2.2%)
Viruses	3 (0.7%)
Alcohol	1 (0.2%)
Idiopathic	165 (37.9%)

4 | DISCUSSION

AP is characterized by inflammation of the pancreas, elevated pancreatic enzymes, and abdominal pain. AP pathogenesis is not fully understood. The etiology is varied; however, gallstones and alcohol are common factors.^{6,7} Determining AP prognosis is difficult; clinical cases range from presenting with slight abdominal pain to fulminant cases resulting in death before any diagnosis can be established. AP incidence is 4.5-35/100000. AP is one of the most common causes of hospitalization in many countries. In western countries, the most common reason for AP is alcohol, while in our country, the most common reason is gallstones. Currently, the AP mortality rate is decreasing as a result of improved treatment modalities. AP mortality occurs most frequently within the first two weeks as a result of multiple organ failure, SIRS, and sepsis.⁸⁻¹⁰ Determination of AP etiology is essential for diagnostic evaluation. This would be useful for directing the treatment and preventing recurrent AP attacks. Gallstones over 5 mm may cause pancreatitis by blocking the common duct, leading to increased pancreatic duct pressure or bile reflux into the pancreatic duct. Gallstones are identified in 35%-40% of pancreatitis patients, while only 3%-7% of bile gallstone patients develop pancreatitis. Here, gallstones were the leading cause of AP (58.6%).^{11,12}

There are many widely used scoring systems for AP prognosis (Ranson, Glasgow, Apache II). Inflammatory mediators play a leading role in AP pathogenesis. Therefore, various inflammatory markers have been studied to establish AP prognosis. NLR is one of the most

studied inflammatory markers and is a good parameter for predicting the immune status of the patient. Both neutrophils and lymphocytes are white blood cells. Increased numbers of neutrophils in the blood indicate increased inflammation. Several studies have shown that decreased numbers of lymphocytes in the blood are associated with sepsis and bacteraemia, but there is no difference in WBC. Thus, NLR may be a superior marker than WBC or single lymphocyte count for predicting AP severity upon admission.

NLR was initially described by Zahorec et al.¹³ In certain studies, elevated NLR in pancreatic cancer was shown to correlate with a negative prognosis.¹⁴⁻¹⁶ Azab et al⁵ suggested a relationship between NLR and the duration of intensive care. Suppiah et al¹⁷ revealed an association between NLR measured in the first 48 hours and the risk of developing severe AP. Zhang et al¹⁸ performed a single-center retrospective study with 974 AP patients. They found a significant association between NLR and the duration of intensive care, the risk of developing persistent organ failure, and mortality. Li et al¹⁹ performed a single-center retrospective study with 359 AP patients and determined NLR to be the most reliable marker of overall survival. Jeon et al²⁰ performed a retrospective study with 490 AP patients and established a relationship between NLR, AP severity, and the development of multiorgan failure. In our study, in accordance with the literature, we established a correlation between NLR and Ranson score, which is a scoring system assessing AP severity. Furthermore, other parameters of the Ranson score were correlated with the duration of intensive care.

Our study has certain limitations, such as being single-center and retrospective. Considering the need for epidemiological studies in our country, and considering the sample size, we believe our study makes a positive contribution to the medical literature.

In conclusion, AP clinical progression can occasionally be very quick and may result in death. Rapid AP diagnosis and treatment are essential. Current scoring systems for AP diagnosis are complicated, whereas NLP is a simple, practical, and effective marker. Further randomized controlled studies are required to verify the effectiveness of NLR.

TABLE 3 Comparison of patients with Ranson score <3 vs patients with Ranson score ≥3

	Ranson <3		Ranson ≥3		Mann-Whitney U test	
Age (Years)	62.07	17.18	74.08	13.54	-4.988	<0.001
Ürea (mg/dL)	30.99	22.53	38.21	19.77	-3.571	<0.001
AST (U/L)	141.78	174.26	378.38	287.90	-6.764	<0.001
ALT (U/L)	163.77	165.70	308.02	204.78	-5.648	<0.001
LDH (U/L)	268.43	129.76	446.36	164.30	-7.759	<0.001
Triglyceride (mg/dL)	128.31	155.69	78.19	38.76	-4.579	<0.001
White blood cell (109/L)	12.30	14.19	15.98	6.41	-5.233	<0.001
Neutrophile (109/L)	9.05	5.68	14.24	6.20	-5.806	<0.001
Lymphocyte (109/L)	1.49	0.69	1.21	0.71	-3.436	0.001
Neutrophile/lymphocyte ratio	8.56	9.68	16.36	11.96	-5.855	<0.001

ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransferase; LDH, lactate dehydrogenase.

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