JOURNAL OF
CONTEMPORARY MEDICINE

DOI:10.16899/jcm.1137585
J Contemp Med 2022;12(6):832-838

Original Article / Orijinal Araştırma

The Role of Combined Hematological Inflammatory Indices in Predicting Poor Outcomes in Patients with Acute Pancreatitis

Kombine Hematolojik İnflamatuar İndekslerin Akut Pankreatit Hastalarında Kötü Sonlanımı Öngörmedeki Rolü

Abuzer Özkan[1], Hatice Şeyma Akça[2]

[1]University of Health Scienses, Ümraniye Education and research hospital, Department of Emergency Medicine, İstanbul, Turkey
[2]University of Karamanoğlu Mehmet Bey, Karaman Education and Research Hospital, Department of Emergency Medicine, Karaman, Turkey

Abstract

Aim: The aim of the instant study is to evaluate the predictability of AISI, NLPR, and SIRI in patients with acute pancreatitis, which predicts more than 7 days of hospitalization, the need for intensive care, and 30-day mortality.

Material and Method: This retrospective observational study was conducted in patients diagnosed with acute pancreatitis who applied to the emergency medicine clinic of Ümraniye Education and Research Hospital between July 15, 2017 and February 15, 2021.Statistical analysis was performed using SPSS v. 26.0.

Results: The study included 592 patients, 58.3% of which were women. A statistically significant difference was found between high NLPR, and hospital stay longer than 7 days (p=0.01). No statistically significant correlation was found between AISI and SIRI and the length of hospital stay (p=0.16, p=0.19, respectively). There was a statistically significant correlation between high NLPR, and mortality (p=0.03). No statistically significant correlation was found between AISI, SIRI, and mortality (p=0.866, p=0.311, respectively). There was a statistically significant correlation between high NLPR, and hospitalization in the intensive care unit (p=0.018) No statistically significant relationship was found between AISI, SIRI, and admission to the intensive care unit (p=0.89, p=0.6, respectively).

Conclusion: According to the results of our study, that there is no relationship between poor outcome and NLPR, AISI, SIRI in patients with acute pancreatitis. Hematological parameters are helpful in predicting the prognosis, but there is a need for differently developed hematological indices in managing acute pancreatitis.

Keywords: Pancreatitis, neutrophil, lymphocyte

Öz

Amaç: Akut pankreatit hastalarında NLPR, AISI ve SIRI nın 7günden fazla hastane yatışı, yoğun bakım ihtiyacı ve 30 günlük mortaliteyi öngörebilirliğini değerlendirmek amaçlandı.

Gereç ve Yöntem: Bu retrospektif gözlemsel çalışma, 15 Temmuz 2017 ile 15 Şubat 2021 tarihleri arasında Ümraniye Eğitim ve Araştırma Hastanesi acil tıp kliniğine başvuran akut pankreatit tanılı hastalarda yapılmıştır. İstatistiksel analiz için SPSS v.26.0 kullanıldı.

Bulgular: Çalışmamıza 592 hasta dahil edilmiş olup, %58,3'ü kadındı. NLPR yüksekliği ile 7 günden daha uzun süre hastane kalış süresi arasında istatistiksel anlamlılık tespit edildi (p=0,01). AISI ve SIRI ile ise hastanede kalış süresi arasında istatistiksel olarak anlamlı ilişki tespit edilemedi (sırası ile p=0,16, p=0,19). Hastalarımızın %5,1'i ex oldu. NLPR yüksekliği ile mortalite arasında istatistiksel olarak anlamlı ilişki mevcuttu (p=0,03). AISI ve SIRI ile mortalite arasında istatistiksel olarak anlamlı ilişki tespit edilemedi (sırası ile p=0,866, p=0,311). NLPR yüksekliği ile yoğun bakıma yatış arasında istatistiksel olarak anlamlı ilişki mevcuttu (p=0,018). AISI ve SIRI ile yoğun bakıma yatış arasında istatistiksel olarak anlamlı ilişki tespit edilemedi (p=0,89, p=0,6)

Sonuç: Çalışmamızın sonuçlarına göre akut pankreatitli hastalarda kötü prognoz ile NLPR, AISI, SIRI arasında bir ilişki yoktur. Hematolojik parametreler prognozu öngörmede yardımcıdırlar fakat akut pankreatit yönetiminde farklı şekillerde geliştirilmiş hematolojik indekslere ihtiyaç vardır.

Anahtar Kelimeler: Pankreatit, nötrofil, lenfosit

Corresponding *(İletişim)*: Hatice Şeyma Akça, University of Karamanoğlu Mehmet Bey, Karaman Education and Research Hospital, Department of Emergency Medicine, Karaman, Turkey
E-mail *(E-posta)*: haticeseymaakca@gmail.com
Received *(Geliş Tarihi)*: 29.06.2022 **Accepted *(Kabul Tarihi)*:** 15.08.2022

INTRODUCTION

Acute pancreatitis can be mild or severe and can rapidly progress. It is the general name given to the pancreas's inflammatory process, which can be acute or chronic. Morbidity can be reduced with timely and effective treatment. As in every period of inflammation, excessive neutrophils count are produced and cell death begins in the lymphocytes count.[1-3] Lymphocyte, neutrophil, and thrombocyte counts can be effective in the inflammation process as well as with the proportional indices between them, and they are also the subject of studies on many chronic inflammatory diseases since they are associated with the prognosis.[4,5]

The neutrophil to lymphocyte ratio (NLR) was studied in relation to asthma,[7] chronic obstructive pulmonary disease (COPD),[8] and intensive care patients.[9] The neutrophil to lymphocyte ratio (NLR), neutrophil/lymphocyte*platelet ratio (NLPR), systemic inflammation response index (SIRI), and aggregate inflammation systemic index (AISI) were examined in patients diagnosed with thyroiditis,[4] rheumatoid arthritis,[5] and pulmonary fibrosis[6] in order to examine the post-operative inflammatory processes[10] even in patients diagnosed with COVID-19.[11-13]

Although we know that the effects of hematological parameters on prognosis in patients with pancreatitis have been examined,[3,14] there was no pancreatitis study using hematological inflammatory indices other than NLR,[1,14] and related to the length of hospital stay, mortality, or intensive care hospitalization rates, as far as we can detect.

The aim of the instant study is to evaluate the predictability of AISI, NLPR, and SIRI in patients with acute pancreatitis, which predicts more than 7 days of hospitalization, the need for intensive care, and 30-day mortality.

MATERIAL AND METHOD

The study was carried out with the permission of the University of Health Sciences, Ümraniye Education and Research Hospital Ethics Committee (Date: 18/03/2020, Decision No: B.10.1.TKH.4.34.H.GP.0.01/62). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Study Design

This retrospective observational study was conducted in patients diagnosed with acute pancreatitis who applied to the emergency medicine clinic of Ümraniye Education and Research Hospital between July 15, 2017 and February 15, 2021. Our hospital is a tertiary education and research institute with 836 beds, and it receives 2.8 million presentations per year.

Study Population

Among the acute pancreatitis patients who presented to the emergency department between July 15, 2017, and February 15, 2021, those over the age of 18 who were clinically and/or laboratory and/or radiologically confirmed, whose hemogram parameters were measured and registered in the emergency department, were included in the study. Patients whose data were missing, mortality information could not be reached, were under 18 years of age, or who refused to participate in the study were excluded.

Data Collection

The patients' data were collected from the hospital records. All of the procedures were carried out in accordance with the ethical rules and principles of the Declaration of Helsinki. Age (year), white blood cell count, neutrophil, lymphocyte count, platelet count, hemoglobin, hematocrit values, mean platelet volume (MPV), mean corpuscular volume (MCV), neutrophil to lymphocyte ratio (NLR), red cell distribution width (RDW) sodium, potassium, glucose, blood urea nitrogen (BUN), creatinine, albumin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and c-reactive protein (CRP) values were recorded. The neutrophil/lymphocyte*platelet ratio (NLPR), AISI (neutrophil*platelet* monocyte/lymphocyte ratio), SIRI (neutrophil*monocyte/lymphocyte ratio) were calculated. The patients' 30-day mortality, length of hospital stay, and intensive care unit admission rates were recorded from the hospital data system. Patients who were hospitalized for 8 days or longer were considered to be hospitalized. The examinations and data of the patients who attended the emergency department were used.

Statistical Analysis

Statistical analysis was performed using SPSS v. 26.0. The conformity of the variables to normal distribution was examined using visual (histogram and probability charts) and analytical (Kolmogorov-Smirnov test) methods. The normal analysis of continuous data was done using the Shapiro-Wilk test. The fisher exact test and chi-square test were used in analyzing the categorical data. The chi-square test was used to evaluate the relationship between the survival and non-survival groups, the groups with long and short hospital stays, and the groups that needed and did not need intensive care. Quantitative variables were presented as median and interquartile range (IQR, 25th–75th percentile) values, and the Mann-Whitney test was used in analyzing the paired groups. For the laboratory parameters, the Mann-Whitney u test was used. Statistical significance was accepted as $p<0.05$.

RESULTS

The study included 592 patients, 58.3% of which were women and 26% of which had a hospital stay longer than 7 days. A statistically significant correlation was found between low lymphocyte count, hemoglobin, hematocrit, and high RDW and hospital stay longer than 7 days ($p=0.01$, $p=0.01$, $p=0.01$, $p=0.01$, respectively).

There was no significant correlation between platelet and WBC and length of hospital stay (p=0.51, p=0.09, respectively). A statistically significant difference was found between high NLR, NLPR, and hospital stay longer than 7 days (p=0.01, p=0.01, respectively). No statistically significant correlation was found between AISI and SIRI and the length of hospital stay (p=0.16, p=0.19, respectively).

There was a statistically significant correlation between total bilirubin, direct bilirubin, and the length of stay in hospital (p=0.01, p=0.01, respectively). Mortality in long-term hospitalized patients is shown in **Figure 1**. The relationship between laboratory parameters and length of hospital stay is shown in **Table 1**.

The length of hospital stay in patients with diabetes mellitus and ischemic heart disease was statistically significantly higher than expected (p=0.007, p=0.007, respectively) (**Table 2**).

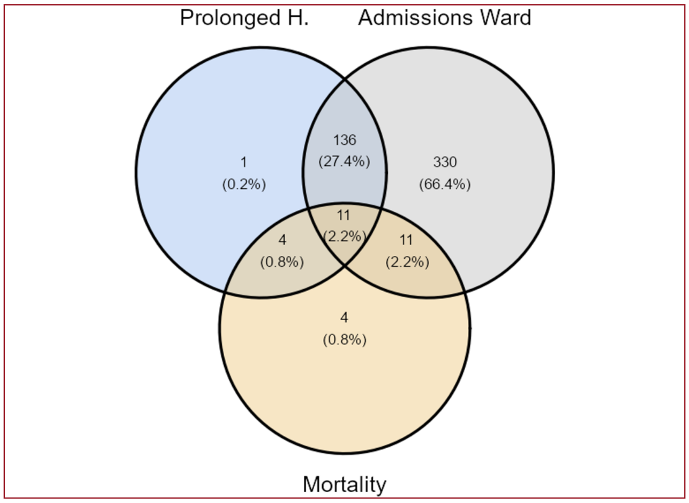

Figure 1. Relationship between long-term hospitalization and mortality

Table.1 Relationship of laboratory parameters, NLR, NLPR, AISI and SIRI with length of stay in hospital

		<= 7 Days N=440 (74%)	> 7 Days N=152 (26%)	p
Admission to Services	488 (82.4%)	341 (78%)	147 (97%)	
Admission to ICU	11 (1.9%)	6 (1.4%)	5 (3.3%)	
Age	58 (45-74)	57.0 (43.0-71.0)	65.5 (48.4-79.0)	0.01
Gender				0.33
Female	345 (58.3%)	262 (60%)	83 (55%)	
Male	247 (41.7%)	178 (40%)	69 (45%)	
Laboratuary parameters				
Albumine	40.5 (37-43.1)	41.0 (37.3-43.7)	39.0 (35.0-42.0)	0.01
CRP (mg/L)	9 (2-33)	8.0 (2.0-28.0)	12.0 (3.0-60.0)	0.04
AST (IU/L)	115 (31.8-261)	113.0 (29.0-264.0)	124.0 (42.1-250.3)	0.44
ALT (IU/L)	96 (24-281)	95.0 (23.0-268.6)	99.5 (28.8-317.2)	0.42
Glucose (mmol/L)	121 (101-151)	118.0 (101.0-147.0)	127.5 (105.8-171.6)	0.02
BUN (mg/dL)	34.2 (25.7-47.1)	32.1 (23.5-42.8)	38.5 (26.6-64.2)	0.01
Creatinine(mg/dL)	0.81 (0.71-1.03)	0.8 (0.7-1.0)	0.9 (0.7-1.3)	0.01
Amylase (U/L)	647 (281-1855)	622.0 (286.8-1802.7)	699.0 (259.8-1937.9)	0.71
Lipase (U/L)	1287 (492-4189)	1200.0 (495.4-4168.6)	1412.5 (461.8-4704.1)	0.95
Potasium (mEq/L)	4.3 (4-4.6)	4.3 (4.0-4.6)	4.3 (4.0-4.7)	0.51
Sodium (mEq/L)	139 (137-140)	139.0 (137-140)	138.0 (136-140)	0.01
Total Bilirubin (mg/dL)	1.31 (0.637-2.77)	1.3 (0.6-2.6)	1.5 (0.8-3.7)	0.01
Direct Bilirubin (mg/dL)	0.6 (0.24-1.6)	0.6 (0.2-1.4)	0.7 (0.3-2.3)	0.01
Indirect Bilirubin (mg/dL)	0.645 (0.35-1.13)	0.7 (0.3-1.1)	0.6 (0.4-1.4)	0.11
Hemogram parameters				
WBC 103µ/L	10.8 (8.48-13.9)	10.8 (8.5-13.3)	11.8 (8.4-15.5)	0.09
Neutrophil (103µ/L)	8.34 (5.92-11.4)	8.2 (6.0-11.1)	9.0 (5.9-12.9)	0.07
Monocyte (103µ/L)	0.56 (0.407-0.74)	0.6 (0.4-0.7)	0.5 (0.4-0.8)	0.31
Lymphocyte (103µ/L)	1.46 (0.97-2.19)	1.5 (1.0-2.3)	1.3 (0.9-1.9)	0.01
Hemoglobin (g/dl)	13.1 (11.9-14.2)	13.2 (12.0-14.4)	12.8 (11.3-13.7)	0.01
Hematokrit (%)	39.7 (36.1-42.9)	40.0 (36.6-43.2)	38.5 (34.9-42.4)	0.01
RDW	14.1 (13.3-15.6)	14.0 (13.2-15.5)	14.3 (13.6-15.9)	0.01
Platelet (103µ/L)	250 (203-306)	249.5 (202.4-301)	249.0 (206.7-328.7)	0.51
MPV	9.2 (8.39-10.1)	9.2 (8.3-10.1)	9.3 (8.4-10.1)	0.48
PDW	16.2 (15.9-16.7)	16.2 (15.9-16.7)	16.2 (16.0-16.8)	0.45
NLR	5.61 (3.09-9.94)	5.4 (3.0-9.5)	6.6 (3.7-12.8)	0.01
NLPR	1366 (811-2447)	1319.4 (746.8-2290.9)	1618.9 (937.7-2829.4)	0.01
AISI	747 (345-1460)	728.134 (6.6-1312.0)	880.7 (322.2-1728.1)	0.16
SIRI	2.87 (1.49-5.77)	2.8 (1.5-5.3)	3.1 (1.3-7.4)	0.19
Length of Stay Hours	98.5 (53-172)	79.5 (31.0-111.0)	244.0 (192.0-329.6)	0.01
Length of Stay Days	5 (3-8)	4.0 (2.0-5.0)	11.0 (8.0-14.0)	0.01

(CRP, C-reaktif protein; AST, aspartat aminotransferaz; ALT, alanin aminotransferaz; BUN, kan üre azotu; WBC, white blood cell; Neu, nötrofil; mono, monosit; hgb,hemoglobin; htc, hematokrit; RDW: red cell distribution width plt, platelet MPV: mean platelet volüme; PDW, Platelet Distribution Width ;NLR, nötrofil/ lenfosit; NLPR, nötrofil/lenfosit*trombosit; AISI, nötrofil*trombosit* monosit/lenfosit ; SIRI, nötrofil* monosit/lenfosit)

Table.2 Relationship of comorbidities with length of hospital stay

		<= 7 Days N=440 (74%)	> 7 Days N=152 (26%)	p
Comorbidity	361 (61.0 %)	247 (56%)	114 (75%)	
Hypertension	277 (46.8 %)	192 (44%)	85 (56%)	0.012
Diabetes Mellitus	138 (23.3 %)	90 (20%)	48 (32%)	0.007
Malignancy	51 (8.6 %)	31 (7.0%)	20 (13%)	0.032
Hyperlipidemia	158 (26.7 %)	107 (24%)	51 (34%)	0.035
Alzheimer	26 (4.4 %)	13 (3.0%)	13 (8.6%)	0.007
Chronic Obstructive Pulmonary Disease	50 (8.4 %)	34 (7.7%)	16 (11%)	0.37
Ischemic Heart Disease	117 (19.8 %)	75 (17%)	42 (28%)	0.007
Asthma	71 (12.0 %)	48 (11%)	23 (15%)	0.22
Heart Failure	35 (5.9 %)	18 (4.1%)	17 (11%)	0.003
Chronic Renal Failure	34 (5.7 %)	20 (4.5%)	14 (9.2%)	0.054
Cerebrovascular Disease	44 (7.4 %)	30 (6.8%)	14 (9.2%)	0.43
Survivor	562 (94.9 %)	425 (97%)	137 (90%)	0.004
Non-Survivor	30 (5.1 %)	15 (3.4%)	15 (9.9%)	

Statistical tests performed: chi-square test of independence; Fisher's exact test

Approximately 5.1% of our patients died, and there was a statistically significant correlation between low monocytes, lymphocytes, hemoglobin, hematocrit count and high RDW (red cell distribution width) and mortality (respectively, p=0.013, p=0.01, p=0.01, p=0.01, p=0.01). There was a statistically significant correlation between high NLR, NLPR, and mortality (p=0.002, p=0.03, respectively). No statistically significant correlation was found between AISI, SIRI, and mortality (p=0.866, p=0.311, respectively) (**Table 3**).

Approximately 1.9% of our patients were admitted to the intensive care unit. There was a statistically significant correlation between low monocyte, lymphocyte, hemoglobin, hematocrit count and high RDW and hospitalization in the intensive care unit (p=0.009, p=0.016, p=0.013, p=0.025, p=0.001, respectively). There was a statistically significant correlation between high NLR, NLPR, and hospitalization in the intensive care unit (p=0.004, p=0.018, respectively) No statistically significant relationship was found between AISI, SIRI, and admission to the intensive care unit (p=0.89, p=0.6, respectively) (**Table 4**).

Considering the biochemical laboratory tests, low albumin was found to be statistically associated with length of hospital stay, mortality, and the rate of admission to the intensive care unit (p=0.01, p=0.001, p=0.001, respectively). With BUN (p=0.01, p=0.001, p=0.001, respectively), creatinine (p=0.01, p=0.014, p=0.011, respectively), and CRP (p=0.04, p=0.001, p=0.001, respectively), a statistically significant relationship was found between the length of hospital stay and the rate of mortality and hospitalization in the intensive care unit. No statistically significant correlation was found between AST and ALT values and the length of hospital stay (p=0.44, p=0.42, respectively).

Table.3 Association of laboratory parameters, NLR, NPR, AISI and SIRRI with mortality

Dependent: Mortality	Survivor	Non-Survivor	p
Age	58.0 (44.0-72.0)	79.5 (68.2-85.8)	
Gender			0.564
Female	326(58%)	19(63%)	
Male	236(42%)	11(36,7%)	
Labararatuary parameters			
Albumine	41.0 (37.4-43.4)	32.4 (29.5-35.4)	0.001
CRP (mg/L)	8.0 (2.0-28.8)	60.5 (26.0-104.5)	0.001
AST(IU/L)	116.0 (32.0-263.0)	72.0 (25.8-214.0)	0.4
ALT(IU/L)	99.0 (25.0-291.5)	48.0 (20.0-98.0)	0.029
Glucose (mmol/L)	122.0 (102.0-151.0)	107.5 (88.2-141.2)	0.127
BUN (mg/dL)	32.1 (23.5-44.9)	59.9 (43.3-137.5)	0.001
Creatinine (mg/dL)	0.8 (0.7-1.0)	1.2 (0.7-2.3)	0.014
Amylase (U/L)	695.5 (289.0-1927.0)	268.0 (178.2-563.2)	0.001
Lipase (U/L)	1430.5 (500.0-4365.2)	455.0 (330.2-921.2)	0.001
Potasium (mEq/L)	4.3 (4.0-4.6)	4.5 (4.3-4.8)	0.009
Sodium (mEq/L)	139.0 (137.0-140.0)	136.0 (134.0-138.0)	0.001
Total Bilirubin (mg/dL)	1.3 (0.6-2.8)	1.4 (0.6-1.9)	0.934
Direct Bilirubin (mg/dL)	0.6 (0.2-1.6)	0.5 (0.3-1.3)	0.717
Indirect Bilirubin (mg/dL)	0.6 (0.3-1.1)	0.6 (0.3-1.1)	0.641
Hemogram parameters			
WBC	10.8 (8.5-13.8)	10.0 (8.5-14.6)	0.645
Neutrophil (103µ/L)	8.3 (5.9-11.3)	8.4 (5.9-13.1)	0.655
Monocyte (103µ/L)	0.6 (0.4-0.7)	0.5 (0.2-0.6)	0.013
Lymphocyte (103µ/L)	1.5 (1.0-2.2)	0.9 (0.6-1.3)	0.001
Hemoglobin (g/dl)	13.1 (12.0-14.3)	11.0 (10.0-13.1)	0.001
Hematokrit (%)	39.8 (36.5-43.0)	33.1 (30.9-38.9)	0.001
RDW	14.0 (13.3-15.5)	15.9 (14.2-17.1)	0.001
Platelet (103µ/L)	250.0 (205.2-306.0)	226.0 (152.8-285.2)	0.023
MPV	9.2 (8.4-10.0)	9.1 (7.8-10.4)	0.718
PDW	16.2 (15.9-16.7)	16.3 (15.9-16.9)	0.808
NLR	5.5 (3.1-9.5)	11.6 (5.3-20.8)	0.002
NLPR	1356.7 (801.7-2289.6)	1894.5 (1085.0-3978.6)	0.03
AISI	746.5 (343.9-1454.0)	814.7 (390.5-1476.4)	0.866
SIRI	2.8 (1.5-5.7)	4.0 (1.8-9.3)	0.311
Length of Stay Hours	97.0 (52.2-167.0)	168.5 (68.0-269.5)	0.014
Length of Stay Days	5.0 (3.0-7.0)	7.5 (3.0-11.8)	0.014

(CRP, C-reaktif protein; AST, aspartat aminotransferaz; ALT, alanin aminotransferaz; BUN, kan üre azotu; WBC, white blood cell; Neu, nötrofil; mono, monosit; hgb,hemoglobin; htc, hematokrit; RDW, red cell distribution width; plt, platelet; MPV, mean platelet volüme; pct, ;PDW, Platelet Distribution Width; NLR, nötrofil/ lenfosit; NLPR, nötrofil/lenfosit*trombosit; AISI, nötrofil*trombosit* monosit/lenfosit ; SIRI, nötrofil* monosit/lenfosit)

Table. 4 Association of laboratory parameters, NLR, NPR, AISI and SIRRI with intensive care admission

Characteristic	No intensive care admission N=581 (98%)	Intensive care admission N=11 (1.9%)	p value
Age	58 (45-73)	77 (70-86)	0.001
Gender			0.035
Female	342(58,9%)	3(27.3)	
Male	239(41.1%)	8(72.7 %)	
Labararatuary parameters			
Albumine	40.8 (37.0-43.3)	35.0 (25.5-36.5)	0.001
CRP	8 (2-32)	87 (42-108)	0.001
AST (IU/L)	115 (32-260)	41 (21-461)	0.78
ALT (IU/L)	96 (25-283)	27 (15-181)	0.19
Glucose (mmol/L)	121 (101-151)	118 (92-140)	0.48
BUN (mg/dL)	34 (24-47)	77 (59-112)	0.001
Creatinine (mg/dL)	0.81 (0.71-1.02)	1.60 (0.93-2.74)	0.011
Amylase (U/L)	675 (284-1,918)	286 (166-557)	0.01
Lipase (U/L)	1,377 (495-4,290)	465 (318-542)	0.001
Potasium (mEq/L)	4.30 (4.00-4.60)	4.50 (4.40-4.65)	0.17
Sodium (mEq/L)	139.0 (137.0-140.0)	138.0 (136.0-139.5)	0.45
Total Bilirubin (mg/dL)	1.32 (0.64-2.78)	1.00 (0.58-1.67)	0.4
Direct Bilirubin (mg/dL)	0.60 (0.24-1.60)	0.52 (0.32-1.07)	0.91
Indirect Bilirubin (mg/dL)	0.65 (0.35-1.14)	0.48 (0.26-0.69)	0.14
Hemogram parameters			
WBC	10.8 (8.5-13.7)	14.3 (10.6-19.3)	0.059
Neutrophil (103µ/L)	8.3 (5.9-11.2)	12.6 (9.8-17.9)	0.017
Monocyte (103µ/L)	0.56 (0.41-0.74)	0.34 (0.12-0.53)	0.009
Lymphocyte (103µ/L)	1.47 (0.98-2.20)	0.98 (0.58-1.27)	0.016
Hemoglobin (g/dl)	13.10 (11.90-14.30)	11.20 (10.05-12.95)	0.013
Hematokrit (%)	39.7 (36.2-43.0)	33.9 (31.5-39.6)	0.025
RDW	14.10 (13.30-15.50)	16.40 (14.95-17.35)	0.001
Platelet (103µ/L)	250 (203-306)	247 (165-332)	0.89
MPV	9.20 (8.40-10.10)	8.70 (7.72-10.30)	0.55
PDW	16.20 (15.90-16.70)	16.10 (15.85-16.55)	0.55
NLR	6 (3-10)	19 (13-27)	0.004
NLPR	1,358 (808-2,295)	2,898 (1,786-6,941)	0.018
AISI	747 (348-1,459)	985 (238-1,529)	0.89
SIRI	2.8 (1.5-5.8)	4.0 (1.4-9.0)	0.6
Length of Stay Hours	98 (53-169)	111 (62-320)	0.21
Length of Stay Days	5.0 (3.0-8.0)	5.0 (3.0-14.0)	0.21

(CRP, C-reaktif protein; AST, aspartat aminotransferaz; ALT, alanin aminotransferaz; BUN, kan üre azotu; WBC, white blood cell; Neu, nötrofil; mono, monosit; hgb, hemoglobin; htc, hematokrit; RDW, red cell distribution width; plt, platelet MPV: mean platelet volüme; PDW, Platelet Distribution Width ; NLR, nötrofil/ lenfosit; NLPR, nötrofil/lenfosit*trombosit; AISI, nötrofil*trombosit* monosit/lenfosit ; SIRI, nötrofil* monosit/lenfosit)

DISCUSSION

In our study, high NLR and NLPR were effective in determing the length of hospital stay, mortality, and intensive care unit admission. We found that AISI and SIRI could not predict the prognosis in patients with acute pancreatitis. In addition, low lymphocyte levels were effective in prognosis.

The neutrophil to lymphocyte ratio, which is active in inflammatory processes, preserved its distinctive feature as in many studies. As far as we could detect, there was no study investigating the effect of NLPR, AISI, and SIRI on prognosis in acute pancreatitis. We think the fact that NLPR is associated with prognosis will affect the approach to acute pancreatitis. In addition to hematological parameters, hematological inflammatory indices were used in different diseases with inflammatory pathophysiology. In a study performed for the differential diagnosis of subacute thyroiditis and including 285 patients, neutrophil, lymphocyte, NLR, SIRI, and AISI values were significantly higher in patients with subacute thyroiditis than in patients in the graves and control group ($P < 0.05$) (4). In a study conducted in patients with rheumatoid arthritis, although NLR, SIRI, and AISI were found to be statistically significantly higher in patients with rheumatoid arthritis than in the control group, they were not found to be superior to each other (AUCs < 0.7) (5). In a study conducted in patients with a diagnosis of pulmonary fibrosis, AISI was above the median value and was statistically significantly correlated with mortality ($p=0.043$). Other hemogram parameters, on the other hand, did not have a statistically significant relationship with mortality. The NLR was statistically insignificant in determining prognosis ($p=0.58$) (6). In a study conducted in patients who had coronary artery bypass surgery, a statistically significant correlation was found between the increase in NLR, SIRI, and AISI values in the postoperative period and mortality ($p < 0.001$) (10).

The effect of hematological parameters on prognosis has been investigated in COVID-19 patients as well as in inflammatory diseases (11,12,13). In a retrospective study in which Eissa et al. investigated 88 patients, when they compared COVID-19 patients with the control group, the thrombocytes and lymphocytes count decreased significantly ($p=0.004$, $p < 0.001$, respectively), and the CRP, NLR, and NLPR increased significantly ($p=0.003$, $p=0.008$, $p < 0.001$, respectively). In the same study, a statistically significant difference was also found in SIRI ($p=0.032$), but no statistically significant difference was found in AISI ($p=0.244$) (11). Fois et al. found a statistically significant correlation between the increase in WBC, lymphocytes, neutrophils count, NLR, NLPR, and SIRI, and mortality in their study involving 119 COVID-19 patients ($p=0.006$, $p=0.012$, $p=0.012$, $p=0.0015$, $p=0.0009$, $p=0.010$, respectively). In addition, a statistically significant relationship was found between AISI and mortality ($p=0.025$) (12). In another study comparing COVID-19 patients according to intensive care hospitalization, the NLR, SIRI, and AISI values were significantly higher in intensive care patients compared to other COVID-19 patients ($p < 0.001$, $p < 0.001$, $p < 0.001$, respectively) (13). In our study, as in patients who had coronary artery bypass surgery and COVID-19 patients, high NLR and NLPR were found to be indicators of poor prognosis, while both AISI and SIRI were not significant as indicators of poor prognosis. As we expected, BUN, creatinine, and CRP were associated with length of hospital stay, mortality, and intensive care unit admission. Alanine aminotransferase was only associated with mortality. Aspartate aminotransferase had no significant relationship with prognosis. In a study in which Ranson criteria were used for prognosis evaluation and 184 patients with acute pancreatitis were examined, a statistically significant correlation was found between BUN, creatinine, AST, ALT, and CRP elevations in severe pancreatitis cases ($p=0.001$, $p=0.003$, $p < 0.001$, $p=0.006$, $p < 0.001$, respectively) (15).

Although we could not find a study on the relationship of NLPR, AISI, and SIRI with prognosis in patients with pancreatitis, the relationship of hematological parameters with prognosis has been examined in many studies. In a study examining hematological parameters, patients with acute pancreatitis had higher lymphocyte, neutrophil, platelet count and NLR values compared to the control group ($p=0.001$, $p=0.001$, $p=0.001$, $p=0.01$) (14). Gülümsek et al. found a statistically significant correlation between low hemoglobin and hematocrit and poor prognosis ($p=0.309$, $p=0.517$, respectively). There was a statistically significant relationship between neutrophils, monocytes count

and poor prognosis ($p < 0.001$, $p < 0.001$, respectively) (15). In a study by Khan et al., in which they examined 154 patients with acute pancreatitis, they found that neutrophil and NLR levels were significantly higher in patients with severe pancreatitis compared to pancreatitis with milder disease ($p < 0.001$) (3). Garg et al., on the other hand, found that there was a significant decrease in NLR level after 48 hours, although not in the first 24 hours ($p=0.09$) ($p=0.017$) (16). In our study, neutrophils count were only significantly associated with intensive care admission. It was determined that low lymphocyte, hemoglobin, and hematocrit levels could be an indicator of poor prognosis.

Limitations

In our study, the first application laboratory parameters of our patients were taken into account. We did not have the opportunity to take control laboratory tests at different times of the inflammatory process. While the length of stay in the hospital and the rate of hospitalization in the intensive care unit were created with precise information, there was no readmission evaluation due to a pancreatitis attack. Newly diagnosed patients were evaluated, since patient admission was taken as the basis, and patients who could not have been diagnosed before but who may have actually had an attack of chronic pancreatitis, could not be excluded from the study.

CONCLUSION

Acute pancreatitis is an inflammatory process that requires serious approach. Hematological parameters are helpful in predicting the prognosis, but there is a need for differently developed hematological indices in managing acute pancreatitis.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of the University of Health Sciences, Ümraniye Education and Research Hospital Ethics Committee (Date: 18/03/2020, Decision No: B.10.1.TKH.4.34.H.GP.0.01/62).

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

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The author has no conflicts of interest to declare.

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

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Li Y, Zhao Y, Feng L, Guo R. Comparison of the prognostic values of inflammation markers in patients with acute pancreatitis: a retrospective cohort study. BMJ Open 2017;7:e013206.
2. Khanna AK, Meher S, Prakash S, et al. Comparison of Ranson, Glasgow, MOSS, SIRS, BISAP, APACHE-II, CTSI Scores, IL-6, CRP, and Procalcitonin in predicting severity, organ failure, pancreatic necrosis, and mortality in acute pancreatitis. HPB Surg 2013:367581.
3. Khan NA, Haider Kazmi SJ, Singh M, et al. Hematological indices predicting the severity of acute pancreatitis presenting to the emergency department: a retrospective analysis. Cureus 2021;13(7): e16752.
4. He P, Yang H, Lai Q, et al. The diagnostic value of blood cell-derived indexes in subacute thyroiditis patients with thyrotoxicosis: a retrospective study. Ann Transl Med 2022;10(6):322.
5. Erre GL, Buscetta G, Mangoni AA, et al. Diagnostic accuracy of different blood cells-derived indexes in rheumatoid arthritis: A cross-sectional study. Medicine (Baltimore) 2020;99(44):e22557.
6. Zinellu A, Collu C, Nasser M, et al. The Aggregate Index of Systemic Inflammation (AISI): A Novel Prognostic Biomarker in Idiopathic Pulmonary Fibrosis. Journal of Clinical Medicine 2021;10(18):4134.
7. Mochimaru T, Ueda S, Suzuki Y, Asano K, Fukunaga K. Neutrophil-to-lymphocyte ratio as a novel independent predictor of severe exacerbation in patients with asthma. Ann Allergy Asthma Immunol 2019;122(3):337-9.
8. Paliogiannis P, Fois AG, Sotgia S, et al. The neutrophil-to-lymphocyte ratio as a marker of chronic obstructive pulmonary disease and its exacerbations: a systematic review and meta-analysis. Eur J Clin Invest 2018;48(8):e12984.
9. Akilli NB, Yortanlı M, Mutlu H, et al. Prognostik importance of neutrophil/lymphocyte Ratio İn Critically İll Patients-Short And Long Term Outcomes,Amj Emerg med 2014;32(12):1476-80.
10. Urbanowicz T, Michalak M, Olasińska-Wiśniewska A, et al. Neutrophil Counts, Neutrophil-to-Lymphocyte Ratio, and Systemic Inflammatory Response Index (SIRI) Predict Mortality after Off-Pump Coronary Artery Bypass Surgery. Cells 2022;11(7):1124.
11. Eissa M, Shaarawy S, Abdellateif MS. The Role of Different Inflammatory Indices in the Diagnosis of COVID-19. Int J Gen Med 2021;14:7843-53.
12. Fois AG, Paliogiannis P, Scano V, et al. The Systemic Inflammation Index on Admission Predicts In-Hospital Mortality in COVID-19 Patients. Molecules 2020;25(23):5725.
13. Hamad DA, Aly MM, Abdelhameid MA , et al. Combined Blood Indexes of Systemic Inflammation as a Mirror to Admission to Intensive Care Unit in COVID-19 Patients: A Multicentric Study. J Epidemiol Glob Health 2022;12:64-73.

14. Ergenç H, Ertürk Z, Eminler AT, Cinemre H. Diagnostic and Prognostic Value of Neutrophil/Lymphocyte Ratio and Platelet/Lymphocyte Ratios on Acute Pancreatitis Patients. OTJHS 2022;7(1):80-5.
15. Gulumsek E, Yesildal F, Avci BS, et al. Monocyte to high-density lipoprotein and derived neutrophil to lymphocyte ratio in patients with acute pancreatitis are associated with the severity of the disease. Int J Med Biochem 2022;5(2):77-83.
16. Garg A, Naskar D, Gupta N, Yelamanchi R, Gupta AK. Comparison of Red Cell Distribution Width and Neutrophil Lymphocyte Ratio with APACHE II Score in Predicting Severity of Acute Pancreatitis. Indian J Surg (2022). Doi:10.1007/s12262-022-03345-z.