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Systemic inflammation response index and systemic immune-inflammation index are associated with severity of acute pancreatitis

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Abstract

Aim: Acute pancreatitis (AP) is a disease with inflammation, and patients present with severe acute upper abdominal pain in emergency departments. AP can result in higher mortality as its clinical severity increases. Therefore, in this study, we want to investigate the clinical utility of the systemic inflammation response index (SIRI) and systemic immune-inflammation index (SII) in showing the severity of AP.

Material and methods: Among the patients admitted to our emergency department between January 2020 and December 2022, 201 patients diagnosed with AP were included in the study. These patients were divided into two groups according to the severity of the disease as mild and severe AP (MAP and SAP). Demographic data and laboratory data of the patients (white blood cell count, such as SIRI, SII and C-reactive protein, SIRI, SII and C-reactive protein) were recorded. Differences between groups of AP patients divided according to disease severity were analyzed.

Results: 165 (82.1%) patients had MAP and 36 (17.9%) patients had SAP. 52.8% of the patients were male. The mean of the SAP group was significantly higher than the SII MAP group (3165.71±3058.42 vs.1043.31±849.15; p<0.001). In addition, SII levels were significantly higher in the SAP group compared to MAP (11.19±6.27 vs. 3.12±3.01; p<0.001). In regression analysis, CRP, SIRI and SII was found to be able to predict SAP in patients with AP. The power of SIRI and SII were found to be higher in predicting SAP [AUC for SIRI: 0.890; [AUC for SII: 0.859].

Conclusion: High SII and SIRI are useful markers that can show the severity of AP.

Key words: acute pancreatitis severity, SII, SIRI, biomarker

Introduction

Acute pancreatitis (AP) is a condition that can cause with severe inflammation-related reactions, and patients often present to the emergency department (ED) with severe acute upper abdominal pain [1,2]. AP is clinically categorized as mild acute pancreatitis and severe acute pancreatitis (SAP), and SAP patients described by multi-organ failure are associated with high mortality [3]. In recent years, there are many studies concentrating on cytokine activation, macrophage-mediated reaction response in SAP patients. Early diagnosis and treatment of SAP patients reduce the rate of mortality and morbidity [4].

Although scorings such as Ranson criteria, Atlanta, and BISAP have been created to demonstrate the severity of AP, it requires the collection of several parameters that may affect the prediction. Ranson criteria from these scoring systems are frequently used. The Ranson criteria are a reliable indicator of the clinical severity and prognosis of acute pancreatitis. Ranson score ≥ 3 is defined as severe pancreatitis. For this explanation, it can cause problems in timing in AP patients for whom early diagnosis and diagnosis are critical [5,6]. Therefore, there is a need for biomarkers that can predict SAP patients quickly and effectively. Many biomarkers, including C-reactive protein (CRP), neutrophil or platelet to lymphocyte ratio (NLR, PLR), and immature granulocyte (IG), have been used effectively by clinicians to define the severity of AP [2,7,8]. Systemic inflammatory response index (SIRI) has been characterized in the literature as an inflammatory marker that can be estimated by the combination of routine whole blood parameters such as neutrophils, monocytes, and lymphocytes [9]. The systemic immune-inflammation index (SII), another inflammatory marker consisting of a combination of neutrophils, platelets, and lymphocytes, has been similarly reported [4]. Recently many studies showed that the prognostic utility of SIRI and SII in

oncological diseases, and gastrointestinal system conditions such as appendicitis, cholecystitis, and cardiovascular system diseases [10,11]. However, there are insufficient studies on whether SIRI and SII can predict the clinical projection of AP. Therefore, in this study, we wanted to show the clinical utility of SIRI and SII in patients with AP.

Material and methods

Patients

This study consists of patients analyzed with AP patient between January 2020- December 2022 after local ethics committee approval. The study protocol adhered to the Declaration of Helsinki's ethical principles and received full approval from the institutional review boards of Antalya Training and Research hospital Ethical Committee with approval ID: 2022/348. In our study, patient data were inspected retrospectively from electronic information processing systems. The investigation population consisted of patients aged ≥18 years who presented to the tertiary hospital (Health Science University Antalya Training and Research Hospital, Antalya, Turkey) ED with abdominal pain, whose clinical, symptom, imaging, and laboratory tests were assessed and were compatible with AP. Typical abdominal ultrasonography and tomography findings in the routine imaging of the patients were accepted as AP. The exclusion criteria in our study were patients <18 years of age, those with exacerbation due to chronic diseases such as patients with hematological or oncological disorders, pregnant women, patients with insufficient data, patients, those guided to an external center, and additional physical examination, examination and imaging findings specified as patients with an infectious disease. Patients were then grouped according to the Atlanta acute disease classification. These were MAP and SAP (including moderate/severe pancreatitis). The MAP group consisted of patients without organ failure and (peri-)pancreatic necrosis, and another group, the SAP group, consisted of patients with permanent or transient organ failure and/or sterile-infected (peri-)pancreatic necrosis. Demographic and clinical characteristics were investigated from the hospital data processing system.

Laboratory tests

CRP, hemoglobin, platelet and white blood cell count (WBC), neutrophil, lymphocyte, monocytes, IG values, amylase, lipase, glucose, liver function tests, and lactate dehydrogenase (LDH) levels of the patients were documented. SIRI calculated in this form: neutrophil count, monocyte count/lymphocyte count, and SII calculated in this formula: platelet count was found by the ratio of neutrophil count/lymphocyte count.

Statistical analysis

In our study, SPSS 21.0 was used in the analysis of the data, and mean ± standard deviation was used for continuous variables. While frequency and percentage (%) were used for categorical data, Pearson chi-square and Fischer's precision test were used in the analysis of categorical variables. Student's t-test was used for normally distributed variables and Mann-Whitney U test was used for non-normally distributed variables in the analysis of groups for AP severity. Parameters with P<0.20 in univariate analysis were entered into a backward multivariate logistic regression analysis. Receiver operating characteristic (ROC) analysis was performed for AP severity (WBC, CRP, SIRI, and SII) and a statistically significant P<0.05 was considered.

Results

Our analysis included 201 patients, including 165 (82.1%) OAB and 36 (17.9%) SAP. 106 (52.8%) of the patients were male. The patients were divided into two groups as MAP and SAP according to the severity of AP, and when they were evaluated between genders according to the severity of AP, it was found that 49.7% of the patients in the MAP group and 66.7% of the patients in the SAP group were male, and there was no significant difference between the groups (p=0.069). When the patients were evaluated according to age groups, the mean age was found to be significantly higher in the severe AP group than in the MAP group (52.69±16.08 vs. 61.78±15.81; p<0.003). Mean WBC, neutrophil, CRP, LDH, and glucose levels were significantly higher in SAP patients compared to the MAP group; lymphocyte levels were found to be significantly lower. While the mean SIRI levels were 3165.71±3058.42 in SAP patients, it was 1043.31±849.15 in MAP patients. Mean SIRI levels were discovered to be significantly higher in SAP patients. While the mean SII levels were 11.19±6.27 in SAP patients, it was 3.12±3.01 in MAP patients. Mean SIRI levels were discovered to be significantly higher in SAP patients. Demographic data and laboratory values of the study population are compared in Table 1.

Table 1 Demographics and laboratory findings in patients with acute pancreatitis

	MAP N=165	SAP N=36	P value
Age (years)	52.69±16.08	61.78±15.81	0.003
Gender (Male);n(%)	82 (49.7)	24 (66.7)	0.069
Laboratory tests			
WBC count (×103/mm3)	8.69±3.32	12.79±5.74	**0.013**
Neutrophil	6.48±3.11	12.23±4.80	<0.001
Lymphocyt	1.78±0.85	1.17±0.64	0.001
Platelet	225.47±80.88	204.08±76.11	**0.845**
CRP (mg/dL)	67.58±8.91	132.9±14.84	**0.017**
ALT (U/L)(IQR)	109 (212.5)	126 (193.5)	0.434
Amylase (U/L)(IQR)	239.5 (436.2)	358 (610)	0.395
Lipase(U/L)(IQR)	335 (875.2)	586 (1061)	0.600
Glucose (mg/dl)	107.03±49.35	139.38±99.21	0.009
LDH(U/L)	241.06±139.06	252.48±85.71	0.035
SII	1043.31±849.15	3165.71±3058.42	<0.001
SIRI	3.12±3.01	11.19±6.27	<0.001

Abbreviation: WBC: White blood cell count; CRP: C-reactive protein; ALT: Alanine transaminase; LDH: Lactate dehydrogenase; SII: systemic immune-inflammation index; SIRI: systemic inflammation response index

Table 2 Predictors of severe acute pancreatitis on multivariate logistic regression analysis

Multivariate logistic regression			
Variable	**OR**	**95% CI**	**P-value**
Age	2.24	1.090-5.108	0.053
Sex(male)	2.04	1.049-4.316	0.068
WBC count	1.094	1.002-1.196	**0.046**
Neutrophil	1.314	1.161–1.488	**0.024**
Glucose (mg/dl)	1.703	1.008-2.877	**0.046**
LDH(U/L)	2.64	1.162-2.554	**0.034**
CRP (mg/dL)	3.17	1.51-6.735	**0.003**
SIRI	8.04	1.137-16.38	**0.020**
SII	6.59	1.13-8.24	**0.035**

Abbreviation: WBC: White blood cell count; CRP: C-reactive protein; ALT: Alanine transaminase; LDH: Lactate dehydrogenase; SII: systemic immune-inflammation index; SIRI: systemic inflammation response index

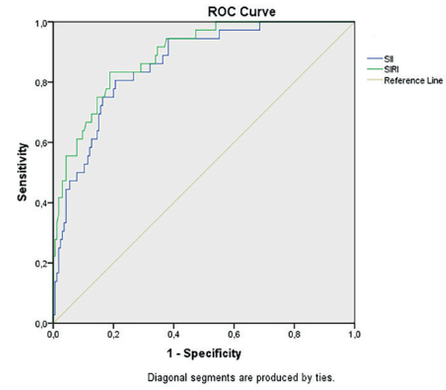

Figure 1 - Receiver operating characteristic curves of systemic inflammation response index (SIRI) and systemic immune-inflammation index (SII) to predict the severity of acute pancreatitis

Table 3 The receiver operating characteristic curves for severe acute pancreatitis prediction

	Cut-off	AUC (95% CI)	Sensitivity (%)	Specificity (%)	P
WBC(×103/mm3)	10.27	0.719 (0.532-0.906)	63.6	51.8	0.03
SIRI	4.83	0.890 (0.837-0.943)	83.8	80	<0.001
SII	1288.2	0.859 (0.798-0.920)	83.3	73.3	<0.001
CRP (mg/dL)	32.7	0.647 (0.476-0.872)	63.6	58.8	0.086

Abbreviation: AUC: Area under the curve; CI: Confidence interval WBC: White blood cell; NLR: Neutrophil lymphocyte ratio ; IGC: Immature granulocyte count; IG%: Immature granulocyte percentage; CRP: C-reactive protein

In regression analysis, CRP, SIRI and SII was found to be able to predict SAP in patients with AP (Table 2). The efficiency of WBC, SIRI, SII, and CRP parameters in determining MAP and SAP was estimated by plotting ROC curves (Figure 1). The effectiveness of WBC, SIRI, and SII in predicting SAP were statistically significant. The power of SIRI and SII was found to be higher [AUC for SIRI: 0.890; sensitivity 83.8, specificity 80 p<0.001]; [AUC for SII: 0.859, sensitivity 83.3, specificity 73.3; p<0.001] (Table 3).

Discussion

In this study, we examined the association between inflammatory markers such as SIRI and SII and the severity of AP. According to the data in our investigation, we found that SIRI and SII were associated with the severity of AP. Accordingly, we think that SIRI and SII may be helpful in the early recognition of SAP patients in the emergency department.

Studies have shown that AP is associated with many systems and organs. It can lead to serious disorders ranging from simple clinical symptoms to severe discomfort and multiorgan failure [12]. The severity of AP continues to be a severe problem for physicians for years. Although the mortality and morbidity rates in patients with AP tend to lower with the developing medical requirements, it still maintains its clinical importance due to the high incidence of SAP [13]. It should be noted that although patients with AP initially progress with an aseptic inflammation, they may show peritonitis, multi-organ failure, and shock in advanced stages [14]. Clinicians used scoring systems such as Ranson's criterion, BISAP score, Harmless acute pancreatitis score, Organ failure-based scores as well as imaging methods such as CT severity index to determine the prognosis and severity of pancreatitis [15,16]. Although these scorings are widely used by clinicians, quick and simple assessment markers become important because they contain many clinical data and difficulties that may occur in calculations [17]. In recent years, fast and simple new types of violence such as NLR, PLR, and IG, and methods that help predictive assessment have been used [2,18]. In this study, we found that SIRI and SII were associated with AP severity.

It has been established that SIRI can be a prognostic marker of many gastrointestinal and cardiovascular diseases, especially oncological conditions. Chao et al. A study by SIRI has highlighted that SIRI is a prognostic index and a potential marker that has significant benefits in patients with treatable cervical cancer [19]. In a study by Dziedzic et al., SIRI was found to be significantly higher in cardiac conditions such as acute coronary syndrome and stable coronary artery disease [20]. Li et al. It has been reported that high SIRI levels are associated with poor survival in patients on peritoneal dialysis due to renal failure [21]. A comprehensive study by Zhang et al. found an association between higher SIRI values and mortality, sepsis, and higher stroke severity [22]. Jin et al. In a study they conducted, it was reported that SIRI could be predictive with low sensitivity and high specificity in patients with rheumatoid arthritis [23]. In our study, we also showed that there is a significant relationship between high SIRI values and SAP.

The systemic immune-inflammation index (SII) has also been reported as a prognostic marker in many conditions such as SIRI [4]. In a study by Li et al., it is used as a potential marker for the poor prognosis of patients with acute/subacute CVST in the pregnant population and men [24]. Trifan et al. In a study by Supratentorial spontaneous intracerebral hemorrhage, early LII is an independent predictor of poor outcome at hospital discharge [25]. Hu et al. emphasized that SII may be associated with circulating tumor cells in patients with hepatocellular carcinoma and may be a strong prognostic marker in patients with hepatocellular carcinoma [26]. Topçuoğlu et al. showed that increased SII values were associated with an improvement in the incidence of symptomatic ICH associated with intravenous thrombolysis [27]. Pedro Silva-Vaz et al., reported 117 patients with AP, found SIRI levels to be significantly higher in severe AP [28]. In another study by Pedro Silva-Vaz et al., for the first time, of SIRI as a new prognostic tool for AP severity [29]. In our study, we exhibited that SII can be a marker for AP severity.

One of the most significant limitations of our study is that our study was created retrospectively. Another limitation of ours is the inability to determine the time from physical examination findings, symptoms, and complaints to sample collection. In

accumulation, SII and SIRI were estimated at a one-time point only. Intermittent measurements to catch changes in these parameters over time and during baseline may contribute to more accurate outcomes. Prospective multicenter studies are required.

Conclusion

It is a useful indicator that can indicate high SII and SIRI AP severity. However, our results should be further estimated using prospective studies with more extended follow-ups.

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