

Relationship Between Laboratory Parameters and Balthazar Severity Score in Acute Pancreatitis

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Abstract

Introduction: Several criteria have been established to assess the severity and prognosis of the disease in patients diagnosed with acute Pancreatitis (AP) in addition to the scoring and classifications developed for this purpose. Our study aims to assess the correlation between the clinical picture and laboratory parameters of patients diagnosed with AP in the emergency department, with a focus on using the Balthazar Severity Scoring to identify the severe cases at an earlier stage.

Materials and Methods: 250 patients over the age of 18 who were admitted to the emergency room due to abdominal pain and were later diagnosed with acute pancreatitis were included in this retrospective study.

Results: According to the Balthazar Severity Score calculated, 194 patients were classified as mild, while 56 as moderate. While there was no significant difference in terms of immature granulocytes percentage between the two groups, LDH and Lipase/Amilase ratio yielded a statistically significant result. The findings with regard to CRP can be considered borderline significant. Sensitivity was 46.4%, specificity was 85%, PPV was 47.2%, and NPV was 84.6% when the NLR cutoff was 14.90. At a lipase/amylase ratio threshold of 2.27, the corresponding NPV was 86.7%, PPV was 26.3%, specificity was 57.2% and sensitivity 69.6%.

Conclusion: Unlike previous studies towards diagnosing severe cases of AP at an early stage, our study found that the percentage of immature granulocyte (IG%) parameter did not show any statistically significant results. The lipase/amylase ratio stands out as a potential distinctive parameter for distinguishing severe cases. Furthermore, while diagnosing severe cases, there were statistically significant differences observed across the groups in relation to WBC, neutrophil, lymphocyte, NLR, PLR, and LDH ratio.

Key words: Acute pancreatitis; balthazar severity score; immature granulocyte percentage; lipase amylase ratio.

Introduction

Acute pancreatitis (AP) is a disorder defined by the activation of non-active pancreatic enzymes in the pancreas due to numerous etiological causes, leading to inflammation and digesting of pancreatic and adjacent tissues (1). In 80% of patients, the clinical picture spontaneously resolves and improves without evolving into any sequel (2). Nevertheless, a significant proportion of patients, ranging from 25% to 30%, may experience a severe clinical condition that poses a life-threatening risk, with mortality rates potentially reaching up to 15% (3). The examinational manifestations of patients with acute pancreatitis are non-specific. Typically, they present to emergency department due to symptoms of abdominal pain. The diagnosis relies on the criteria of sudden onset abdominal pain, serum lipase or amylase ratios above three times the normal n value, and the presence of

specific traits indicative of acute pancreatitis on screening. The diagnosis is then made in the event that two of the three criteria are met (4). In patients diagnosed with AP, various criteria and scores have been set (Atlanta Criteria, Bedside index of severity in acute pancreatitis (BISAP) scoring, Balthazar Violence Scoring, Ranson Criteria, etc.) to determine the weight, prognosis of the disease. Despite all scores and studies, it can be particularly difficult to predict severe cases (5). The percentage of immature granulocyte (IG%) has been introduced in clinics as a new inflammatory indicator (6). IG% can be measured faster than a full blood count (7). In this study, we aimed to evaluate the clinical pictures of patients who presented to the emergency department with complaints of abdominal pain and were diagnosed with AP, evaluating whether there was a relationship between the laboratory values we obtained and the Balthazar Severity Scoring, thus

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enabling the diagnosis of particularly the severe cases at earlier onset.

Materials and Methods

The study was conducted with 250 eligible patients out of 300 who applied to the emergency department of a tertiary university hospital between 01 January 2018 and 01 August 2021 with complaints of abdominal pain and were later diagnosed with "Acute Pancreatitis". Demographic information, vital parameters, complete blood count and biochemical parameters of the patients included in the study were recorded at the time of admission to the emergency department. Patients who underwent Computerized Abdominal Tomography (CT) were divided into groups as mild (0-3), moderate (4-7), and severe (8-10) based on the Balthazar Severity Score. Since no patients exhibited a Balthazar Severity Score above 8, patients were analyzed in two groups as mild and moderate according to the severity score. The relationship between the blood values we recorded and the patients grouped according to the Balthazar Severity Score was analyzed.

Inclusion criteria :

- Presenting to the Emergency Department with acute abdominal pain and being diagnosed as

Acute Pancreatitis

- To be over 18 years old
- Patients with sufficient medical data.

Exclusion criteria:

- Pregnant ones
- Those with haematological diseases
- Patients with insufficient medical data.

Ethical approval: Approval for this study was obtained from Manisa Celal Bayar University Non-interventional Clinical Research Ethics Committee with decision number 20.478.486//24.11.2021

Statistical analyses: Descriptive statistics are presented as mean \pm standard deviation and median (minimum-maximum) for continuous variables and number of people (n) and percentage (%) for nominal variables. The suitability of the data for normal distribution was evaluated by Kolmogorov-Smirnov Test. The Mann-Whitney U Test was used to determine whether there was a difference between the two groups in terms of continuous variables. ROC analysis was used for performance evaluation of diagnostic tests and sensitivity, selectivity, positive and negative predictive values were calculated. Results were considered statistically significant for $P < 0.05$.

Table 1: Relationship between the CBC values and the groups categorized by balthazar severity scoring

		Mild	Moderate	P value
WBC	Median (Min – Max)	11540.00 (3440 – 31160)	13985.00 (6200 – 34210)	0.001*
	Mean \pm SD	12383.30 \pm 4721.266	15075.54 \pm 5583.84	
Neutrophil	Median (Min – Max)	8845.00 (2780 – 27500)	11505.00 (3660 – 31590)	0.001*
	Mean \pm SD	9776.55 \pm 4545.518	12703.39 \pm 5408.27	
Lymphocyte	Median (Min – Max)	1665.00 (50 – 7880)	1185.00 (20 – 5650)	0.016*
	Mean \pm SD	1843.35 \pm 1250.42	1509.46 \pm 1219.02	
IG%	Median (Min – Max)	.10 (0 – 4.20)	.10 (0 – 8.10)	0.102*
	Mean \pm SD	.17 \pm .34	.39 \pm 1.15	
NLR	Median (Min – Max)	5.39 (.87 – 203.20)	11.65 (1.13 – 755.50)	0.001*
	Mean \pm SD	9.77 \pm 16.72	27.56 \pm 99.74	
PLR	Median (Min – Max)	149.51 (25.78 – 4520.00)	211.53 (4.02 – 8600.00)	0.006*
	Mean \pm SD	227.95 \pm 364.56	435.38 \pm 1134.87	

*Mann-Whitney U Test; **SD:** Standart Deviation; (Min-Max): Minimum and Maximum values; **WBC:** White Blood Cell; **IG%:** The percentage of immature granulocyte; **NLR:** Neutrophil/Lymphocyte ratio; **PLR:** Platelet/Lymphocyte ratio

Results

Of the 250 patients included in the study, 135 were women and the mean age was 56.11 years. The pain status of the patients on admission was evaluated through the Visual Pain Scale (VAS) and 23 patients were in the mild group (1-3 points), 154 in the moderate group (4-6 points) and 73 in the severe group (7-10 points). In AP etiology, 68.4% were found to be due to biliary

origin, 4% due to alcohol, 27.6% due to other causes. According to the Balthazar Severity Score we calculated, 194 (77.6%) patients were listed in the mild group and 56 (22.4%) in the moderate group and there was no significant difference between the groups in terms of gender and comorbidities in the Balthazar Severity Score ($P > 0.05$). Given the patients outcome, 215 were hospitalized in the ward, 18 were hospitalized in intensive care and 17 patients were discharged.

When the severity of the groups categorized through Balthazar Severity Score in line with laboratory values, a statistically significant difference was found between mild and moderate severity groups in terms of White Blood Cell (WBC), neutrophil, lymphocyte, Neutrophil/Lymphocyte ratio (NLR) and Platelet/Lymphocyte ratio (PLR) values (P values 0.001, 0.001, 0.016, 0.001, 0.006, respectively)

(Table 1). When the same groups with biochemical blood parameters were compared, lactate dehydrogenase (LDH) was found to be statistically significant in terms of the Lipaz/Amylase ratio (P values are 0.001 and 0.001, respectively). In terms of C-reactive protein (CRP), the results can be interpreted as borderline significant (P= 0.051) (Table 2).

Table 2: Relationship between biochemical values and groups categorized by balthazar severity scoring

		Mild	Moderate- Severe	P value
LDH	Median (Min – Max)	298.00 (125 – 1266)	388.50 (143 – 2732)	0.001*
	Mean ± SD	362.20 ± 211.33	499.21 ± 389.37	
Amylase	Median (Min – Max)	865.00 (22 – 5748)	1226.50 (37 – 6921)	0.310*
	Mean ± SD	1215.73 ± 1178.44	1428.66 ± 1327.16	
Lipase	Median (Min – Max)	2290.50 (34 – 108129)	2189.50 (10 – 12541)	0.585*
	Mean ± SD	3720.39 ± 8251.94	2951.04 ± 2884.62	
Lipase/Amylase	Median (Min – Max)	2.45 (.31 – 18.81)	1.80 (.15 – 6.98)	0.001*
	Mean ± SD	2.96 ± 2.08	2.09 ± 1.27	
CRP	Median (Min – Max)	1.07 (.10 – 29.80)	1.45 (.10 – 67.06)	0.051*
	Mean ± SD	4.19 ± 6.44	7.99 ± 14.01	

*Mann-Whitney U Test; **SD:** Standart Deviation; (Min-Max): Minimum and Maximum; **LDH:** Lactate Dehydrogenase; **CRP:** C-reactive Protein

Table 3: ROC analysis values

	AUC	P	95% Confidence Interval		Sensitivity	Specificity	PPV	NPV
			Lower Limit	Upper Limit				
WBC>13165	0.65	0.001	0.49	0.74	0.62	0.62	0.32	0.85
NLR>14.90	0.67	0.001	0.34	0.59	0.46	0.85	0.47	0.84
RDW>13.45	0.58	0.060	0.49	0.74	0.62	0.5	0.28	0.83
Lipase/Amylase >2.27	0.65	0.001	.56	0.80	0.69	0.57	0.31	0.86
CRP>0.48	0.58	0.051	0.78	0.94	0.89	0.29	0.26	0.90

AUC: Area Under Curve; **WBC:** White Blood Cell; **NLR:** Neutrophil/Lymphocyte ratio; **RDW:** Red Cell Distribution Width; **CRP:** C-reactive Protein; **PPV:** Positive Predictive Value; **NPV:** Negative Predictive Value

The capacity of WBC, NLR, red cell distribution width (RDW), Lipase/Amylase, CRP values to differentiate the severity of pancreatitis was analyzed by ROC analysis and cut-off values were determined. When the cut-off value for WBC was 13165, a sensitivity of 62.5%, 62.8% specificity, 32.7% PPV and 85.3% NPV were calculated, and when the cut-off for NLR was 14.90, a sensitivity of 46.4%, 85% specificity, 47.2% PPV and 84.6% NPV were determined. When the cut-off for RDW was 13.45, a sensitivity of 62.5%, 55.1% specificity, 28.6% PPV and 83.5% NPV were calculated. On the other hand, when the cut-off for lipase/amylase ratio was 2.27, 69.6% sensitivity, 57.2% specificity, 26.3% PPV and

86.7% NPV were obtained. The role of IG% values in determining the severity of acute pancreatitis was not statistically significant as a result of ROC analyses. When the cut-off value for CRP was 0.48, sensitivity was measured as 89%, specificity as 29.3%, PPV as 26.3% and NPV as 90.4% (Table 3).

Discussion

Abdominal pain is among the common reason for admission to the emergency room worldwide. AP is one of the most important diagnoses to be considered in this process due to its high mortality and morbidity values. Even if AP patients

experience severe abdominal pain, this is usually not correlated with the course of the disease (8). It has been included among the diagnostic criteria that there should be a 3-fold or more increase in amylase and lipase values among the biochemical parameters for the diagnosis of AP (9). Although both values aid in making the diagnosis on their own, they remain insufficient in determining the severity and prognosis of the disease (10). A study by Vissery et al. (11) showed that serum amylase and lipase values were not effective on mortality. On the other hand, in the results obtained from our study, it was observed that amylase and lipase values alone were not statistically significant in determining the severity of the disease. However, the lipase/amylase ratio in our study was statistically significant in predicting the severity of the disease ($P=0.001$). When the cut-off value of lipase/amylase value was taken as >2.27 , its specificity was found to be 57.22% and sensitivity was 69.64%. In the study by Anitha et al. (12) when the cut-off value of serum lipase/amylase ratio was >3.0 , the specificity was found to be 52% and sensitivity 68.9%. Again, Sadowski et al. (13) demonstrated that the Lipase/Amilase ratio was sensitive but not specific. In a study by Sternby et al. (14) the relationship between AP and CRP was analyzed and they found a sensitivity of 98% and a specificity of 54% when the cut-off value was >57.0 in their attempt to predict the severity of AP. In the study by Yiğit et al. (15) when the cut-off value for CRP was >90.7 mg/l, specificity was calculated as 81% and sensitivity as 87.3% to differentiate severe pancreatitis cases. In our study, when the cut-off point for CRP was >0.48 mg/dL, we found a sensitivity of 89% and a specificity of 29% while determining the severity. Statistically, the P value was 0.051 and was considered statistically significant. Some studies in the literature have recognized the increased leukocyte counts as a parameter to predict the severity of AP. Karakulak et al. (16) found that leukocyte counts were found to be high in cases of severe AP and its specificity was 86.5% and sensitivity was 60%. Szabo et al. (17) determined the specificity of leukocyte values as 78% and sensitivity as 76% while detecting AP cases. In contrast to these studies, Farkas et al. (18) reported that leukocyte counts were not useful in predicting the severity of AP at the time of admission and in the first 1 day afterwards. In our study, when the predictive power of leukocyte value for severe AP cases was analyzed by ROC analysis, when the cut-off point was >13165 , the specificity was calculated as 62.8% with a sensitivity of 62.5%. P value was calculated as

0.001 and it was shown to have the potency to differentiate severe cases. NLR is a ratio obtained by dividing the number of neutrophils by the number of lymphocytes. In many studies in the literature, the relationship of this value with the inflammatory process has been examined. Li et al. (19) showed that NLR value was a significant parameter in determining the severity and mortality rate of the disease in patients with AP. Mercan et al. (20) showed that the NLR value was significantly higher in patients with acute abdominal pathology on CT compared to those without. In our study, it was shown that the NLR yielded significant results in terms of the potential to differentiate the severe cases, and when the cut-off was >14.90 , $AUC=0.67$, $P=0.001$, sensitivity was 46.4%, and specificity was 85%. Our data were found to be compatible with the literature. It has been shown that immature granulocyte (IG) cells can be used as an early inflammation marker (21). Ayres et al. (22) showed that IG% is a parameter that can be employed in patients with sepsis. Huang et al. (23) showed that IG% counts in AP patients can help differentiate cases that may develop ARDS in the early period. Ünal et al. (24) calculated the sensitivity of IG% in AP patients as 100% and the specificity as 95% for necrotizing pancreatitis when the cut-off value was 0.8. Karakulak et al. (16) determined the specificity as 95% and the sensitivity as 39% when the cut-off value was taken as 1.1%. In another study by Lipiński et al. (25) they calculated the sensitivity of the IG% as 100% and the specificity as 96.2% when the cut-off value of the IG% value was 0.6 in differentiating severe cases in AP patients. As a result of our study, the IG% value did not give statistically significant results in differentiating severe cases contrary to many studies. For the IG% value, a statistically significant difference was found between patients admitted to the intensive care unit and patients admitted to the ward and patients discharged. These results suggest that more detailed studies should be conducted on the use of IG% value in predicting severity and mortality in AP patients. In addition, another result of our study showed that although lipase and amylase values alone did not have significant results in detecting severe cases, Lipase/Amilase ratio gave statistically significant results in distinguishing severe cases in AP patients. With more comprehensive studies to be conducted in the future, Lipase/Amilase ratio may be a parameter that can be used to identify severe cases in the early period.

Study limitations: Since the study was conducted in a single center, the data do not cover the whole

region. The fact that we did not include pregnant and pediatric cases in the study does not make it possible to generalize the results to all AP patients. More comprehensive and multicenter studies are needed for generalization.

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