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CLINICAL STUDY

Predictive value of immature granulocyte percentage and neutrophil lymphocyte ratio in terms of prognosis in the course of acute pancreatitis

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ABSTRACT

AIM: We aimed to investigate the role and importance of immature granulocyte percentage and neutrophil/lymphocyte ratio in the etiology, diagnosis and follow-up of acute pancreatitis (AP) in patients tentatively diagnosed with AP in the emergency department. We evaluated these factors alongside other established markers proven effective in the diagnosis and follow-up of AP.

MATERIAL AND METHODS: A total of 139 patients with a tentative diagnosis of acute pancreatitis who were hospitalized and followed up in the gastroenterology clinic in 2021–2022 were included in the study. In addition, a control group, consisting of 139 individuals admitted to the clinic for various other reasons, was established. The cases were also compared with the control group in terms of NLR, ICG and IG%.

RESULTS: There was a significant difference in the NLR, IGC and IG% measurements between the patients in the AP group and the control group. In all three markers, the average values of the patient group were higher than those of the control group. Furthermore, a significant difference in IGC and IG% blood measurements was noted between sub-groups of patients categorized based on the severity of acute pancreatitis, particularly the patients with severe pancreatitis exhibited higher mean IGC and IG% blood measurements compared to those with mild or moderate pancreatitis.

CONCLUSION. IGC and IG% values emerged as superior indicators to other acute-phase reactants for detecting inflammation, determining its severity, and establishing prognosis in acute pancreatitis. While the N/L ratio remains an important parameter in acute pancreatitis, our findings indicate that it was not significantly superior to other investigated markers in terms of prognosis *(Tab. 5, Ref. 35)*. Text in PDF www.elis.sk

KEYWORDS: acute pancreatitis, neutrophil/lymphocyte ratio, immature granulocyte percentage.

Introduction

Statistically, acute pancreatitis stands out as one of the most frequent and financially burdensome causes of hospitalizations among gastrointestinal diseases. Predisposing causes of acute pancreatitis include obstruction (gallstones, tumors, parasites, duodenal diverticulum, annular pancreas, choledochocele), alcohol, toxins and drugs, metabolic abnormalities (hypertriglyceridemia, diabetes mellitus, hypercalcemia), infections, vascular disorders (vasculitis, pancreatic vascular emboli, hypotension/ischemia), trauma, surgery, ERCP, hereditary/genetic/familial factors, pancreatic divisum, sphincter of Oddi dysfunction, and idiopathic causes (1). Acute pancreatitis is an acute inflammatory process of the pancreas with cases ranging from mild abdominal symptoms to severe lethal conditions (2). The inflammation of the pancreas may cause local damage, systemic inflammatory response syndrome and organ failure (3). In this respect, the importance of formulating clear and applicable recommendations for the diagnosis and treatment of acute pancreatitis, associated with significant morbidity and mortality, has been emphasized (4). Acute pancreatitis should be suspected in patients presenting with clinically severe acute upper abdominal pain, contingent upon biochemical or radiological evidence (5). Important biomarkers used in the diagnosis and prognostic evaluation of acute pancreatitis include amylase and c-reactive protein (6), percentage of immature granulocytes (7), neutrophil/lymphocyte ratio (8) and leukocyte increase. Currently, no gold standard laboratory parameter used to determine the diagnosis and severity of AP has been identified.

As of today, the revised Atlanta classification (2012) is still widely accepted as the most frequently used and most important method of determining the severity of the disease (1).

In this study, we enrolled patients diagnosed with acute pancreatitis in the emergency department and subsequently treated in hospital. We aimed to elucidate the role, importance and relationship of various laboratory markers including novel parameters such as IG% and N/L, which are easily applicable and accessible during the initial evaluation. In addition, it was our objective to evaluate

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the association of these factors with the severity of symptoms, imaging signs of pancreatitis, and the presence of biliary or non-biliary pancreatitis, as well as stones in the biliary system, biliary sludge or both. This comprehensive approach allowed for a more in-depth exploration of acute pancreatitis in terms of predictive factors, and potentially facilitating earlier treatment and follow-up to prevent complications.

Materials and methods

The study received scientific and ethical approval from the Clinical Research Ethics Committee of R. T. E University Faculty of Medicine with decision number 2021/104, dated 27/05/2021, numbered E-40465587-050.01.04-129. The cohort comprised 139 male and female patients aged over 18 years, diagnosed with acute pancreatitis in the emergency department and subsequently followed up in the gastroenterology clinic between 2021–2022. A control group was established for comparison analysis. Demographic information of the patients, including age and sex, as well as parameters such as WBC, neutrophil count (Neu), lymphocyte count (Lym), neutrophil/lymphocyte ratio (NLR), immature granulocyte count and percentage (IGC and IG%), amylase, CRP, imaging findings (USG-MRG-CT) were recorded. The patients were sub-grouped based on the presence of biliary and non-biliary acute pancreatitis, imaging signs of acute pancreatitis, and presence of gallstones, biliary sludge or both in the biliary system. The classification of pancreatitis severity (mild, moderate or severe) was determined according to the Atlanta 2012 classification based on findings and follow-up observations. ALT, AST and bilirubin values were used to differentiate between biliary and non-biliary pancreatitis. The cases were then compared with the control group in terms of NLR, ICG and IG%. Patient data and reference values for biomarkers were retrieved from the hospital automation system. The individuals who had undergone surgical procedure in the past 3 months, those with infection or additional inflammatory disease other than acute pancreatitis, and those with malignancies were not included in the study.

Statistical analysis

Statistical analysis was conducted using SPSS 22 program. Frequency and percentage analyses along with descriptive statistics were primarily employed. For statistical comparisons, the chi-square analysis method was used to examine the relationship between categorical variables; the independent groups t-test analysis method was applied for comparing continuous measurements between two groups, and the Kruskal–Wallis analysis method was used for comparing three groups. The normality of measurements for the independent groups t-test was determined by the skewness and kurtosis values. These values fell within the range of ±1, indicating normal data distribution (Tabachnick and Fidell, 2013). Due to the data insufficiency among study groups for the Kruskal–Wallis method, the alternative method of one-way analysis of variance (ANOVA) was used. Statistical comparisons were conducted at a significance level set at $p<0.05$.

Tab. 1. Description of patient and control groups.

	Patient group (n=139)		Control group (n=139)		
	X±ss	(Min–Max)	X±ss	(Min–Max)	
					p*
Age	64.7±18.5	(20–97)	53.7±13.1	(19–80)	
WBC	11.3±4.6	(2.5–33.8)			
Neu	9.2±4.4	(1.5–31.5)			
Lym	1.4±1	(0.08–6.1)			
NLR	11.8±17.9	(1.2–132)	2.17±1.05	(0.8–6.2)	**<0.001**
IGC	0.07±0.08	(0–0.44)	0.02±0.02	(0–0.1)	**<0.001**
IG%	0.66±0.92	(0–10)	0.29±0.26	(0–1.6)	**<0.001**
Amylase	1730.2±1630.1	(22–9089)			
CRP	35.8±53.5	(0.5–284)			

Results

The mean age of the patients was 64.7 years, ranging from 20 to 97. In the control group, the average age was 53.7 years, ranging from 19 to 80. The distribution of both age and hematologic parameters across study groups, including values derived from blood count are summarized in Table 1. In our study, we compared the immature granulocyte count (IGC), immature granulocyte percentage (IG%) and neutrophil/lymphocyte ratio (NLR) values of patients with acute pancreatitis with those of the control group. The significance of mutual differences was identified through statistical analysis. The independent groups t-test method was used to determine the differences in the IGC, IG% and NLR measurements between patient and control groups. Notably, there was a significant difference in the IGC, IG% and NLR measurements between patients and control group ($p<0.001$). For all three measurements, the mean values of the patient group were higher than those of the control group.

Independent groups t-test

The distribution of male and female genders among patients with acute pancreatitis was 43.2% and 56.8%, respectively. Biliary and non-biliary pancreatitis constituted 67.6% and 32.4%, respectively. Pathological imaging findings in the biliary system were present in 56.8% of the patients and absent in 43.2%. Among those with positive findings, stones, stones and sludge, and biliary sludge were observed in 64.6%, 20.3%, and 15.2% of patients, respectively. Imaging-detected pancreatitis was present in 66.9% of patients and absent in 33.1%. Regarding blood values, WBC values within the reference range were observed in 39.6% of patients, low in 2.9% and high in 57.6% of patients. Physiological neutrophil (Neu) counts were noted in 31.7%, low in 2.2% and high in 66.2% of the patients, Lymphocyte (Lym) counts were within normal range in 73.4%, low in 23.7% and high in 2.9% of the patients. Amylase blood values were normal in 6.5% and elevated in 93.5% of patients, while CRP blood values were normal in 29.5% and elevated in 70.5% of patients (Tab. 2).

The Kruskal–Wallis analysis method was employed to compare blood measurements across subgroups of patients with mild, moderate or severe pancreatitis according to the revised 2012 Atlanta criteria. This method was chosen due to the smaller number of data points in the group with severe pancreatitis (f=13) in contrast to the other groups. There was a significant difference in IGC and IG% measurements between subgroups of patients categorized according to the severity of acute pancreatitis ($p<0.05$). The distinctions among the pancreatitis severity subgroups were further compared pairwise using the Mann–Whitney U test analysis method. A significant difference in IGC and IG% measurements emerged between patients with severe pancreatitis and those with mild or moderate pancreatitis, with higher mean values for IGC and IG% blood measurements in patients with severe pancreatitis. However, no differences were observed in IGC and IG% measurements between mild and moderate pancreatitis subgroups ($p>0.05$). Moreover, there was no significant difference in WBC, Neu, Lym, NLR, amylase and CRP measurements across pancreatitis severity subgroups ($p>0.05$) (Tab. 3).

The relationship of age with and imaging-detected pancreatitis in both biliary and non-biliary pancreatitis groups was examined using chi-square analysis. A statistically significant difference in age was observed between the biliary and non-biliary groups ($p<0.05$). In either age range (below/over 64 years), the number of patients was higher in the biliary group than in the non-biliary group. Similarly, among the patients with or without acute pancreatitis, positive findings on imaging, the prevalence of biliary involvement was higher in either age range. The comparison of blood values between biliary and non-biliary groups was analyzed using the independent groups t-test analysis. The difference in the mean lymphocyte and amylase values between biliary and non-biliary patient groups was significant ($p<0.05$). Specifically, the mean lymphocyte count was higher in non-biliary patients, while the mean amylase value was higher in biliary patients. No significant differences were observed in mean values of other blood parameters between biliary and non-biliary pancreatitis patient groups ($p>0.05$) (Tab. 4).

The comparison of blood measurements for patients with imaging-detected sludge, stones or both was analyzed using the Kruskal–Wallis analysis method, a. non-parametric method chosen due to data insufficiency across all groups. Among patients with biliary pancreatitis, no statistically significant difference was observed in any of blood values between patients with sludge, stones, or both ($p>0.05$) (Tab. 5).

Tab. 2. General characteristics of the patient group with acute pancreatitis.

Demographic	**Group**	**n (%)**
Gender	Male	60 (43.2)
	Female	79 (56.8)
Biliary – Non-Biliary Pancreatitis	Non biliary	45 (32.4)
	Biliary	94 (67.6)
Biliary Finding on Imaging	Absence	60 (43.2)
	Presence	79 (56.8)
Type	Sludge	12 (15.2)
	Stone	51 (64.6)
	Both	16 (20.3)
Pancreatitis on imaging	Absence	46 (33.1)
	Presence	93 (66.9)
Blood value		**n (%)**
WBC	Normal	55 (39.6)
	Low	4 (2.9)
	High	80 (57.6)
Neutrophil (Neu)	Normal	44 (31.7)
	Low	3 (2.2)
	High	92 (66.2)
Lymphocyte (Lym)	Normal	102 (73.4)
	Low	33 (23.7)
	High	4 (2.9)
Amylase	Normal	9 (6.5)
	High	130 (93.5)
CRP	Normal	41 (29.5)
	High	98 (70.5)

Discussion

Establishing the prognosis in the early stage of acute pancreatitis remains extremely challenging for clinicians, particularly within the first hours of evaluation. However, the establishment of accurate and prompt prognosis, determination of etiology, severity, and progression of disease in the early stages of acute pancreatitis enable appropriate guidance of patients and timely therapeutic intervention. Therefore, the potential to employ easily accessible and affordable parameters such as those attainable through the use of many modern hematological analyzers represents a valuable perspective for clinicians.

Prognostic scoring systems (APACHE 2, SIRS, Ranson, BISAP, Balthazar, Glasgow), as well as the Atlanta classification, have been established to determine the severity of acute pancreatitis, the risk of multiple organ failure and mortality. However, assessing these scores can be complicated and time-consuming for physicians during the initial phase of evaluation. While some laboratory indices such as IL-6, CRP, serum lipase and amylase are easily accessible, their results are reported to be inconsistent and sometimes unrelated to disease severity (9, 10). The Atlanta criteria, on the other hand, have several disadvantages limiting

Tab. 3. Comparison of acute pancreatitis severity and blood values.

	Mild	**Moderate**	**Severe**	**p**
WBC	11.1±4.9	11.3±4.4	11.9±3.4	0.426
Neu	8.9±4.8	9.3±4.2	9.9±2.9	0.311
Lym	1.6±1.1	1.3±0.7	1.2±1.2	0.241
NLR	9.7±11.8	12.7±18.8	20.6±34.4	0.136
IGC	0.1±0.1	0.1±0.1	0.1±0.1	**0.031***
IG%	0.6±1.2	0.6±0.5	1±0.7	**0.035***
Amylase	1597.1±1550.9	1975.2±1822.3	1421.2±1048	0.507
CRP	32.2±48.4	41.5±59.5	30.9±55.6	0.944

*p<0.05

Tab. 4. Comparison of variables in biliary and non-biliary pancreatitis groups.

Variables	Non-biliary	Biliary	p
Age			
<64	29 (45.3)	35 (54.7)	**0.003***
>=64	16 (21.3)	59 (78.7)	
Pancreatitis on imaging			
Absence	9 (19.6)	37 (80.4)	**0.023***
Presence	36 (38.7)	57 (61.3)	
Blood Values			
WBC	11.4±4.6	11.2±4.6	0.781**
Neu	8.9±4.4	9.3±4.5	0.612**
Lym	1.7±1	1.3±0.9	**0.044****
NLR	9.6±17.8	13±18	0.289**
IGC	0.1±0.1	0.1±0.1	0.552**
IG%	0.8±1.5	0.6±0.5	0.158**
Amylase	1079.9±1081	2041.6±1757	**0.001****
CRP	41±61.1	33.3±49.7	0.431**

*Chi-Square; **Independent Groups T-test

Tab. 5. Characteristics of blood values by variables in biliary pancreatitis.

	Sludge	Stone	Both	p
WBC	12.7±7.6	10.7±4.5	11.4±3.9	0.610*
Neu	10.7±7.5	8.9±4.6	9.4±3.8	0.800*
Lym	1.2±0.5	1.1±0.7	1.4±0.9	0.322*
NLR	9.9±7.2	21.8±35.2	9.6±8.9	0.724*
IGC	0.1±0.2	0.1±0.1	0.1±0.1	0.560*
IG%	0.9±0.9	0.5±0.3	0.6±0.4	0.474*
Amylase	1842.6±1866.4	2153.6±1504.3	1986.6±1783.3	0.647*
CRP	32.3±47.9	31.8±48.1	35.8±54.5	0.976*

* Kruskal–Wallis test

their utility. The main drawback lies in their inability to clearly distinguish between predicted and actual severity of severe acute pancreatitis, which is crucial given that a significant proportion of patients initially presumed to develop severe acute pancreatitis do not experience severe disease (10, 11). As of today, the revised Atlanta 2012 criteria are still accepted and used as the most compelling classification criteria associated with disease severity (1).

WBC count and CRP are nonspecific markers of inflammation. High WBC count, as indicated by Ranson criteria, Glasgow, APACHE-II and BISAP and SIRS scores, has been linked to poor prognosis (12, 13).

In addition to factors stemming from methodology of blood sample processing potentially impacting the accuracy of hematological measurement, the WBC count may also fluctuate due to various physiological and pathological conditions such as hydration status, stress, and pregnancy (13).

The studies conducted by Fisic and Poropat showed that IL-6, IL-8, IL-10 and soluble tumor necrosis factor receptor (TNFr) measured at admission, along with CRP and pancreatic elastase measured on day 3 of admission, served as valuable prognostic factors for predicting the severity of the disease and systemic complications in patients with acute pancreatitis. Notably, they found that CRP reached statistical significance when measured on day 3 (14). In a separate study, they observed that CRP reached its peak on day 2. Therefore, the CRP value measured at hour 48, rather than at admission, was more significant in indicating the severity of acute pancreatitis (15).

In several studies, it was emphasized that evaluating the severity of acute pancreatitis in the early stage of symptom onset is crucial for improving the patient prognosis. Therefore, there is a recognized need for readily accessible indicators with the potential to accurately prognose the outcomes of patients within 24 hours following the onset of the disease (16, 17).

Immature granulocytes are the first cells to be released from the bone marrow during infection and inflammatory conditions. Their presence in peripheral blood indicates ongoing leukopoiesis and may serve as the earliest indication of bone marrow stimulation triggered by infection, inflammation, or any other stimuli (18). In this respect, it can be inferred that their appearance precedes the changes in WBC count or neutrophil count.

The immature granulocyte count is a recent addition to the differential blood cell counting, offering advantages such as fast processing time and low cost. To effectively use this parameter in clinical analysis, it is essential to identify potential pathologic levels and establish healthy reference values (19).

In their study, Lipiński and Rydzewska noted that the percentage of immature granulocytes can serve as an independent biomarker in predicting the severity of acute pancreatitis (9).

Tae Y Kim, Sun J Kim. stated that the Delta neutrophil index (DNI), which is strongly associated with immature granulocyte count, exhibits the highest predictive value for severe acute pancreatitis (SAP) among biomarkers such as WBC and CRP. Additionally, they emphasize that immature granulocyte count plays a more prominent role in determining SAP compared to WBC count and CRP (7).

Unal and Barlas reported that immature granulocytes can be used as an early marker of inflammation and increased IG% is a simple, rapid, and effective marker for the early prediction of acute necrotizing pancreatitis. In their study, they explored the significance of NLR, CRP and IG% as important markers in predicting acute necrotizing pancreatitis. Notably, IG% exhibited higher sensitivity, specificity, AUROC, and both negative and positive predictive values (100%, 95%, 0.982%, 78.9%, 100%, respectively). They also determined that IG% had a sensitivity of 100% and specificity of 95% for acute necrotizing pancreatitis with a cut-off value set at 0.8 (20). Bedel et al. similarly emphasized that IGC and IG% were more effective indicators of acute pancreatitis severity compared to traditional markers of inflammation such as WBC, NLR and CRP (21).

Lipinski and Rydzewska established physiological reference values for IG%, finding a specificity and sensitivity of over 90% at a cut-off value of 0.6% for prognosing severe acute pancreatitis (9). Ayres et al, excluded the diagnosis of sepsis in patients with a cut-off value below 2 for IG%, achieving a specificity of 90.9% and sensitivity of 38.5%. They identified IG% as a marker suitable for early diagnosis in patients with sepsis (22). Karakulak et al observed higher IG% levels in patients with severe pancreatitis (p=0.018) and determined the cut-off value of >1.1 through ROC analysis to determine disease severity (23).

Neutrophils and lymphocytes offer a more nuanced view of the immune response than the total WBC count (24–25). Since neutrophilia and lymphopenia are indicators of systemic inflammation and physiological stress, they can provide a better reflection of complications such as necrosis or organ failure (13).

Our study also utilized the neutrophil/lymphocyte ratio (NLR), a key player in prognosing the outcome of acute pancreatitis. Numerous studies have identified NLR as an index reflecting the prognosis of various inflammatory or malignant diseases (24–26). This cost-effective and straightforward test, routinely performed as part of initial evaluation of patients, remains unaffected by the patient's volume status and is easily repeatable (12, 13).

Bhanou et al propose the utility of NLR as an indicator of the severity of acute pancreatitis at the time of initial diagnosis, predicting the need for intensive care and estimating the duration of hospital stay (27). Numerous studies increasingly associate NLR with AP, highlighting its superior performance over other serum markers in predicting severity and prognosing AP (28). Notably, one study demonstrated the superiority of NLR over total WBC counts in predicting acute pancreatitis severity (13). In their study, Abayli et al explored the relationship between NLR and Ranson score and concluded that, compared to the practicality of the current AP scoring systems, NLR emerges as a straightforward, practical and effective marker (29). The study conducted by Yilmaz et al compared NLR with CRP regarding their utility in early prediction of AP severity. In line with our findings, they observed significantly higher NLR values in patients with severe AP. However, they noted that CRP demonstrated greater significance than NLR as an early indicator of severe disease, with a cut-off value of 6.8, and 113 mg/L for CRP (30).

Because NLR has no alternative reference range, most clinics calculate NLR based on the normal reference range provided by diagnostic laboratories. Most of the available studies evaluating the utility of NLR as a prognostic marker have used a cut-off value of ≥5 to predict adverse outcomes of the disease (24–25). Suppiah et al also conducted a detailed study to determine the optimal NLR in acute pancreatitis and identified distinct optimal limits for various groups based on their highest neutrophil and lowest lymphocyte counts. As a result, they concluded that NLR, elevated within the first 48 hours of admission, was significantly associated with severe acute pancreatitis and was an independent negative prognostic indicator in AP (12).

Jeon and Park in their study investigating the prognostic value of NLR in patients with AP for determining an optimal cut-off value in predicting adverse outcomes, stated that NLR was a reliable predictor of adverse outcomes and the initial optimal cut-off value of NLR for predicting severity in acute pancreatitis was 4.76 while the cut-off value of 4.88 was optimal for predicting organ failure (8). Katuwal and Shilpakar found that a cut-off NLR of 8.02 was associated with acute severe pancreatitis with 60% sensitivity and 60.4% specificity (31). Kokulu et al. reported that with a cut-off value set at >7.13, NLR is a valuable parameter in predicting the development of complications in patients with AP, demonstrating 87.50% sensitivity and 69.05% specificity at (32).

In alignment with our study, Kara et al investigated the significance of NLR as a prognostic marker for differentiating biliary from non-biliary involvement in patients diagnosed with AP. They concluded that, although NLR was found to be elevated in acute pancreatitis, the difference in NLR values between non-biliary and biliary pancreatitis was insignificant (33). Cho et al, in their study conducted on biliary and alcoholic pancreatitis groups, reported that NLR and CRP values demonstrated a significantly superior predictive power only in biliary pancreatitis (34).

Based on the findings of aforementioned in-depth study analyses, it can be concluded that IG% and NLR values hold greater significance than other parameters in the prognosis of acute pancreatitis. However, it is acknowledged that further comprehensive and follow-up studies are needed to determine the optimal values for these parameters. Therefore, our study was carried out by considering statistical average values for these parameters and establishing a control group.

Our study incorporated all laboratory parameters that are easily and promptly accessible for physicians in an emergency department, including novel parameters such as IG%, IGC, and N/L. Additionally, our statistical analysis encompassed the severity of acute pancreatitis (according to Atlanta 2012), biliary etiology and imaging findings for providing a more comprehensive assessment. We hold that the results of this investigation have the potential to facilitate early diagnosis and prompt initiation of treatment.

In some other studies, it has been observed that laboratory parameters, imaging findings, and evaluation scores were examined daily and evaluated based on follow-up, which may be seen as a deficiency in our study. However, considering the development of many different complications in hospitalized patients, the sensitivity of these parameters to additional stress factors, and the beneficial impact of being able to establish an accurate prognosis during the initial 24 hours for the subsequent treatment of acute pancreatitis, our study focused on parameters that can be evaluated already in the emergency department. Furthermore, the fact that IG%, IGC, and N/L, which are the main parameters of our study, constitute the basis for statistical analysis in the currently used Atlanta classification for the severity of acute pancreatitis highlights the uniqueness of our research compared to other studies.

Upon analyzing the parameters in our study, we observed trends consistent with other research, apart from higher prevalence of female gender, biliary pancreatitis, and stone etiology compared to sludge or both on biliary system imaging. Notably, approximately one third of the patients were diagnosed with AP exhibited no detectable signs of pancreatitis on imaging Amylase, CRP, neutrophil, and WBC values were found to be

higher in the majority of patients (93.5%, 70.5%, 66.2%, 57.6%, respectively). This finding leads us to the assumption that amylase, typically not considered a crucial prognostic marker, holds significance in the diagnostic process. As indicated in other studies, CRP, a factor commonly affected by various pathologies, emerges as a more substantial marker 24–48 hours post admission. In addition, the absence of pancreatitis detection on imaging for some patients underscores the potential inadequacy of early imaging, emphasizing the need for a comprehensive and in-depth evaluation of laboratory findings, encompassing a wide range of parameters.

N/L, IGC and IG% patient values were found to differ significantly from those of healthy subjects ($p<0.001$). Across all measurements, the mean values in the patient group were higher compared to the control group. Notably, significant differences were observed in IGC and IG% blood measurements across patient subgroups stratified based on the severity of acute pancreatitis ($p<.05$). The patients with severe pancreatitis yielded higher IGC and IG% blood measurements compared to those with mild or moderate pancreatitis. Conversely, the differences in WBC, Neu, Lym, NLR, amylase and CRP blood measurements across severity subgroups were insignificant ($p>0.05$). This finding underscores the pivotal role of IGC and IG% values in predicting acute pancreatitis when considering all laboratory parameters. Furthermore, in patients with no negative imaging findings, the ICG and IG% values emerge as superior prognostic markers.

The mean age and the prominence of signs of pancreatitis on imaging were higher in the biliary group. This suggests that the prevalence of biliary involvement increases with age, along with more evident findings on pancreatic imaging. This combination of these facts may be indicative of a worse prognosis in individuals diagnosed with biliary pancreatitis at and advanced age compared to other causes (such as drugs, trauma, etc.).

There was a significant difference in mean lymphocyte counts and amylase between the biliary and non-biliary patients ($p<0.05$). While the mean lymphocyte count was higher in non-biliary patients, the mean amylase value was higher in biliary patients. The differences in means of other blood values between biliary and non-biliary patients did not reach the level of significance ($p>0.05$). These results suggest that amylase levels tend to be higher in biliary disease. It is acknowledged that amylase levels may not increase in certain cases of acute pancreatitis due to high triglyceride levels and alcohol consumption. Thus, the elevated amylase level at the initial emergency admission should be considered a more consequential marker for biliary pancreatitis, however its significance should be evaluated in conjunction with other relevant criteria. Nevertheless, it is crucial not to overlook the differential diagnosis of non-pancreatitis amylase elevations. In this respect, the lack of significance in N/L, IGC and IG%, which are primary markers of inflammation, supports the notion that amylase elevation may be affected by biliary etiology beyond inflammation.

Examining other studies (35), it can be concluded that alongside ALT, GGT, ALP and bilirubin values, the amylase levels play an important role in biliary etiology.

In our study, the patients with findings of sludge, stones or both on biliary imaging exhibited no statistically significant differences in all blood values. This indicates that the presence of stones, sludge, or both on imaging does not impact laboratory parameters.

Conclusion

Acute pancreatitis is an inflammatory disease. In our study, IGC and IG% values were found to be superior to other acute phase reactants in detecting inflammation, determining its severity and predicting outcomes in acute pancreatitis cases. Although the N/L ratio is recognized as an important parameter in acute pancreatitis, our study did not demonstrate its significant superiority in terms of prognosis. The accessibility of IGC and IG% values is crucial in this context. Notably, these values were found to be independent of biliary or non-biliary etiology. Consequently, we advocate for the widespread consideration of IGC and IG% values in all patients suspected of acute pancreatitis, as well as endorsing their routine use in the diagnosis, follow-up and prognosis.

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