

Evaluating mean platelet volume as a new indicator for confirming the diagnosis of necrotizing pancreatitis



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Evaluation mean platelet volume as a new indicator for confirming the diagnosis of necrotizing pancreatitis.

BACKGROUND: The aim of the present study is to discuss the possible role of mean platelet volume as a new predictor in the diagnosis of necrotizing pancreatitis.

METHODS: Study subjects are arranged in three different groups: Group I; control group (n= 40), Group II; acute pancreatitis (n= 40), Group III; necrotizing pancreatitis (n= 36). Demographic data and mean platelet volume values are recorded retrospectively.

RESULTS: Mean platelet volume of patients in Group II was 7.9 ± 0.53 , while in Group III patients' it was 7.2 ± 0.52 ($p < 0.001$). When we compared the study groups with ROC analysis, results demonstrated that cut off value of necrotizing pancreatitis patients as 7,8 (area under curve: 0.857), sensitivity as 86.1% and specificity as 72.5%.

CONCLUSION: The current study shows that mean platelet volume in necrotizing pancreatitis patients is significantly reduced compared to that of patients in the control and acute pancreatitis group.

KEY WORDS: Diagnosis, Mean platelet volume, Necrotizing pancreatitis

Introduction

Owing to the development of parenchyma necrosis, acute necrotizing pancreatitis (ANP) is identified as severe acute pancreatitis¹. Acute pancreatitis (AP) is a non-bacterial inflammatory disease of the pancreas and its symptoms may manifest in a mild form, interstitial edema, or in the most severe form, pancreatic necrosis. Although

the disease is self-limited and regresses in a few days in 80% of the AP cases, approximately 20% of AP cases show symptoms of ANP². Once diagnosed, intensive care support, wide spectrum antibiotics, and surgical debridement enable improved prognosis. However, septic complications and organ failures owing to bacterial infection of pancreatic necrosis account for 80% of the disease-related deaths^{3,4}. Recently, through advances in imaging techniques and medical approaches, considerable improvements have been made in the diagnosis and treatment of necrotizing pancreatitis (NP). However, a direct correlation between the presence and severity of necrosis assessed using computerized tomography (CT) examinations and clinical tables, and systemic and infectious complications cannot always be determined². Therefore, additional diagnostic methods are necessary for differentiating NP from AP and for confirming the diagnosis of ANP. Platelets (PLT) play an important role in haemostasis, thrombosis, and coagulation, and the size and den-

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sity of circulating platelets are heterogeneous⁵. Mean platelet volume (MPV) is a blood parameter used for measuring platelet size and is accepted as a marker for determining platelet functions. Larger platelets have more metabolic and enzymatic activity, and their prothrombotic potential is greater than that of smaller platelets⁷. Elevated MPV is associated with other markers of platelet activity such as increased platelet aggregation, increased thromboxane synthesis, increased β -thromboglobulin release, and increased expression of adhesion molecules⁸. Platelets secrete a large number of substances that are important mediators of inflammation, coagulation, thrombosis, and atherosclerosis^{9,10}. MPV can be easily determined through routine blood tests, and is therefore cost-effective and time-effective (yields results promptly)⁶. This study aims to discuss the potential role of MPV, which is associated with numerous vascular pathologies, as a new predictor in differentiating NP from AP and in providing a confirmed diagnosis of NP.

Materials and Methods

Seventy-six patients were admitted to our center January 2006 and December 2013 for abdominal pain and were diagnosed with NP and AP, using clinical, laboratory, and radiological imaging techniques. Furthermore, 40 people were included in the control group. Study subjects were arranged in three different groups: Group I, control group (n = 40); Group II, medically treated patients diagnosed with AP (n = 40); and Group III, surgically operated patients diagnosed with NP (n = 36). In Group II, 40 patients were selected from among 350 patients who were diagnosed and treated for AP to achieve homogeneity in terms of age and gender among the three groups. These patients in Group II were treated using imipenem antibiotics and all of them responded to the therapy. Except for the control group, all the patients had undergone suitable antibiotic therapy. We retrospectively analysed all the patient's files. Age, gender, haemoglobin count (Hb) (g/dl), white blood cell (WBC) count ($\text{mm}^3 \times 10^3$), MPV (fL), PLT count ($\text{mm}^3 \times 10^3$), and C-reactive protein (CRP) (mg/L) are recorded

for all patients when they are admitted to the hospital for purposes of evaluation.

LABORATORY DATA

The blood samples for all the patients were drawn from the antecubital vein following a 12-hour fasting period. The MPV, haemoglobin count, PLT count, and WBC count were measured for all the patients and these measurements were performed immediately after blood sampling to avoid platelet swelling induced by ethylenediaminetetraacetic acid (EDTA). For analysing the haematologic parameters, blood samples with K3-EDTA were processed by a Sysmex XT-2000i analyser, which uses the electric resistance detecting method with hydrodynamic focusing and fluorescence flow cytometry (Sysmex, Kobe, Japan).

STATISTICAL ANALYSIS

The SPSS (Statistical Package for Social Sciences) Windows 15.0 program was used for conducting the statistical analysis and evaluating the results. The quantitative data were indicated as mean $\pm$ standard deviation. The Kolmogorov-Smirnov test was utilized for evaluating the compatibility of normally distributed data. For drawing comparisons among the groups, the Mann-Whitney U test was employed for analysing the non-parametric data, the Student t test was employed for the parametric data, and the chi-square test was used for analysing the categorical data. P-values of less than 0.05 were considered significant for all variables. Receiver-operating characteristic (ROC) analyses were used to determine the cut-off values and the sensitivity/specificity of MPV.

Results

Seventy-six of the enrolled patients were diagnosed with pancreatitis (AP and NP), whereas the remaining 40 peo-

Table I - Demographic features and laboratory values of the patients and controls.

	Pancreatitis (groupII and III) (n=76)	Control group (n=40)	p
Age (year)	53.7 $\pm$ 16.4	56.4 $\pm$ 10.9	NS
Gender (F/M)	49/27	22/18	NS
Hb (g/dl)	13.2 $\pm$ 2.2	13.7 $\pm$ 1.8	NS
MPV (fL)	7.5 $\pm$ 0.62	8.3 $\pm$ 0.94	<0.001
PDW (%)	17.1 $\pm$ 2.18	16.9 $\pm$ 2.31	NS
WBC ($\text{mm}^3 \times 10^3$)	17.9 (5.0-25.6)	7.3 (2.9-12.5)	<0.001
PLT ($\text{mm}^3 \times 10^3$)	251 (86-840)	245 (108-540)	NS
CRP (mg/L)	15.5 (0.3-43)	1.1 (0.1-2.4)	<0.001

NS: not significant; MPV: mean platelet volume; WBC: white blood cell; CRP: C-reactive protein; Hb: hemoglobin.

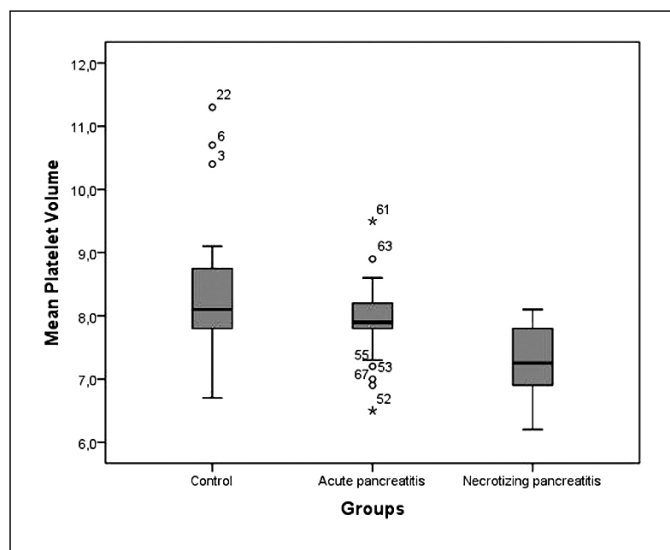


Fig. 1: MPV levels of the patients (AP and NP) and healthy controls

ple served as the control group. In the pancreatitis group, 27 patients were male and 49 were female, whereas in the control group, 18 were male and 22 were female ($p = 0.213$). The mean age for the pancreatitis group was 56 ± 10.9 , whereas it was 53.7 ± 16.4 for the control group ($p = 0.255$). On comparison, we found that the MPV values of the patients in the pancreatitis group ($= 7.5 \pm 0.9$) were lower than those in the control group ($= 8.3 \pm 0.9$) ($p < 0.001$). Other comparison parameters for the groups are shown in Table I. The MPV levels of the three groups were compared and the mean MPV values were 8.3 ± 0.94 , 7.9 ± 0.53 , and 7.2 ± 0.52 for Groups I, II, and III, respectively (Fig. 1). Groups II and III were compared in terms of gender; in Group II, 24 patients (60%) were female and 16 were male (40%), whereas in Group III, 25 were female (69.4%) and 11 were male (30.6%) ($p = 0.390$). The mean ages of the patients in Groups II and III were 52.6 ± 16.5 and 54.9 ± 16.4 , respectively ($p = 0.547$). The mean MPV levels for patients in Groups II and III were 7.9 ± 0.53 and 7.2 ± 0.52 , respectively and the difference between these mean MPV levels for the two groups was statistically significant ($p < 0.001$). The mean post-operative MPV value of Group III patients was 7.79 ± 0.67 . Although an increase in the mean MPV values was detected when compared with the mean pre-operative

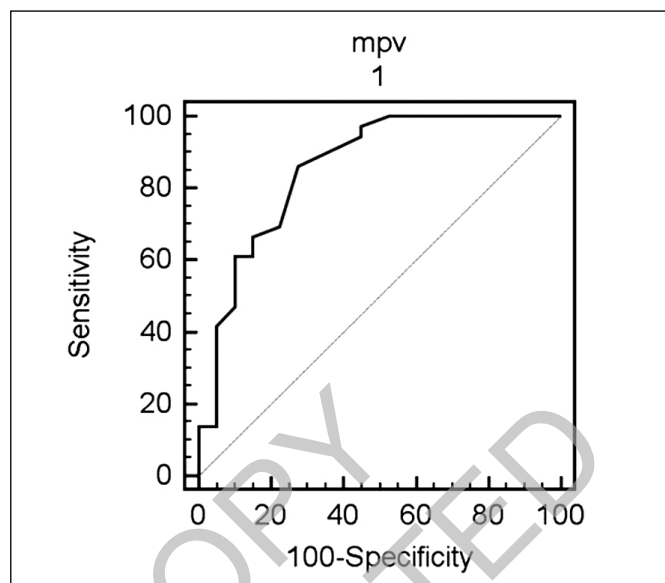


Fig. 2: Receiver operating characteristic curves for predictors of necrotizing pancreatitis. MPV values (area under the curve (AUC) 0.857); green line; reference line.

values, the difference was not statistically significant ($p = 0.207$). Other inflammation parameters of Groups II and III are shown in Table II. When NP and AP patients were compared using ROC analysis, a cut-off value of 7, 8 was obtained for the NP patients (area under curve (AUC): 0.857), and the sensitivity and specificity was 86.1% and 72.5%, respectively ($p < 0.001$) (Fig. 2).

Discussion

AP is an inflammatory disease of the pancreas, which is most frequently a result of gallstone disease or excessive alcohol intake. AP is associated with significant morbidity and mortality risks. Although a majority of the patients with AP may suffer only a mild, self-limiting form of the disease, others may develop more severe symptoms of the disease, resulting in organ failure, and the mortality rate in such cases is over 50%¹¹. ANP is a common form of AP and its morbidity and mortality rate is much higher than that of AP¹². It is imperative to determine the severity of the disease for estab-

Table II - Comparison of inflammation parameters between Group II and III

	Acute pancreatitis (n=40)	Necrotizing pancreatitis (n=36)	p
MPW (fL)	7.9 ± 0.53	7.2 ± 0.52	<0.001
WBC ($\text{mm}^3 \times 10^3$)	16.2 (5.0-28.0)	16.7 (6.0-25.6)	NS
CRP (mg/L)	9.5 ± 7.8	22.1 ± 10.8	<0.001

MPV: mean platelet volume; WBC: white blood cell; CRP: C-reactive protein

lishing the level of inflammatory activity and enabling appropriate therapeutic modifications, because effective treatment can significantly reduce the mortality rate of patients with ANP^{13,14}. Radiological imaging techniques, and pathological and biochemical analyses are the most commonly used methods for diagnosing pancreatic inflammation. Apart from these, numerous invasive and non-invasive methods have also been investigated for diagnosing and determining the activity of ANP. Thus far, the role of platelets in the pathophysiology of ANP is not clearly defined and there is no ideal serum marker for diagnosing NP and determining its severity. Although leucocytosis and an increase in CRP are frequently observed in ANP patients, both of them are non-specific determinants of inflammation and infection¹⁵. When measured in the early phase of the disease, CRP levels do not reflect the severity of the disease in AP patients. In ANP, sensitivity and the positive predictive values of serum CRP levels reportedly range from 83% to 100% and from 37% to 77%, respectively¹⁶. In our study, ROC analysis showed a CRP sensitivity of 82.5% and specificity of 92.5% for NP patients. Moreover, CRP values for the AP and NP group of patients were higher than the control group ($p < 0.001$). Gurleyik et al.¹⁷ also measured serum CRP among AP patients and determined a CRP sensitivity of 84% and specificity of 73%; they also reported the potential to determine the severity of the disease effectively. Albayrak et al.¹⁸ determined a WBC sensitivity of 76.5% and specificity of 90.8% in acute appendicitis cases. In another study on acute appendicitis by Shafi et al.¹⁹, a WBC sensitivity of 97.8% and specificity of 55.6% was found. In our study, the ROC analysis showed a WBC sensitivity of 83.3% and specificity of 90.5% for AP and NP patients. Furthermore, the difference between the WBC levels of AP and NP patients and control patients proved to be significant ($p < 0.001$). MPV is a simple marker of platelet function and activation, and is influenced by inflammation. Moreover, MPV can be determined by a complete blood count (CBC) and thus does not entail additional costs. An increase in MPV levels have been established in numerous conditions such as metabolic syndrome, myocardial infarction, acute ischemic stroke, and diabetes mellitus²⁰. Kisacik et al.²¹ indicated a decrease in MPV levels in cases where patients suffered from active rheumatic arthritis and ankylosing spondylitis. Woong et al.²² and Albayrak et al.¹⁸ also showed decreased levels of MPV in acute appendicitis cases. In our study, the MPV levels for Groups II and III (AP and NP patients, respectively) were significantly lesser than those of the patients in Group I (control group) ($p < 0.001$). On comparing Groups II and III (i.e., the AP and NP groups, respectively), we found that the MPV levels of Group II were lower than those of Group III ($p < 0.001$). When NP and AP patients were compared using ROC analysis in our study, the results demonstrated that the sensitivity for MPV values of NP

patients was 86.1%, specificity was 72.5%, and AUC was 0.857 ($p < 0.001$). In terms of CRP, the NP group of patients had higher levels of CRP than the AP group ($p < 0.001$). There was no significant difference in the WBC levels between these two groups ($p = 0.325$).

Conclusion

MPV is a blood parameter that is commonly used for measuring platelet size. It can be determined in routine blood tests, and is therefore both cost-effective and time-effective (yields results promptly). In this study, we established that the MPV levels of NP patients are significantly lesser than those of the control and AP groups. Consequently, we propose that besides radiological imaging modalities, reduction in MPV levels can also be considered for determining the severity of the disease and confirming the diagnosis of NP in patients with pancreatitis.

Riassunto

Lo scopo di questo studio è quello di discutere il possibile ruolo del volume medio delle piastrine quale nuovo indice di previsione nella diagnosi di pancreatite necrotizzante.

I pazienti arruolati nello studio sono stati suddivisi in tre gruppi differenti: 1° Gruppo di controllo con 40 pazienti; 2° Gruppo di 40 pazienti con pancreatite acuta; 3° Gruppo con 36 pazienti con pancreatite necrotizzante. I dati demografici ed i valori del volume medio piastrinico sono stati registrati in modo retrospettivo.

Il valore piastrinico medio nei pazienti del 2° Gruppo è risultato 7.9 ± 0.53 , mentre nel 3° Gruppo è risultato 7.2 ± 0.52 ($p < 0.001$). Nel paragonare i gruppi con l'analisi ROC (Receiver Operating Characteristic), i risultati hanno dimostrato 7,8 (area sotto la curva: 0,857) il valore limite per i pazienti con pancreatite necrotizzante, con una sensibilità pari al 86,1% ed una specificità pari al 72,5%. In conclusione lo studio dimostra che il volume piastrinico medio nei pazienti con pancreatite necrotizzante è significativamente ridotto nei confronti di quello dei pazienti di controllo ed anche del gruppo delle pancreatiti acute.

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