Changes in platelet parameters in leukocytosis

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Abstract

Introduction: in recent years, platelets are known to have a large variety of functions in many pathophysiological processes and their interaction with endothelial cells and leukocytes is known to play an important role in the pathophysiology of vascular inflammation. The aim of this study was to investigate the relationship between white blood cell count in conditions resulting in leukocytosis and platelet count and platelet parameters including mean platelet volume, platelet distribution width, and plateletcrit. Methods: White blood cell counts count and all platelet parameters were evaluated in 341 results of normal complete blood count (of which the white blood cell counts were within reference range, group 1) and 327 results of elevated white blood cell counts count (group 2). Results: There was a significant difference between these two groups in PLT counts and PCT values, being higher in Group 2. However, there was no statistically significant difference between two groups in MPV and PDW values. On the other hand, there were statistically significant, but weak, correlations between the WBC and platelet counts in both groups (p<0.01, r=0.235 for group 1, p<0.05, r=0.116 for group 2). Conclusion: As a conclusion PLT count and PCT values increase in infectious conditions. This study and previous studies show that PLTs are employed in infectious conditions but the exact mechanism and the exact clinical importance of this response remains to be cleared by further studies.

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Introduction

Platelets (PLTs) play an important role in the primary hemostasis and arterial thrombosis formation. They provide rapid protection against bleeding and catalyze the formation of stable blood clots [1,2]. In addition to the fact that the central role of the platelets is to control bleeding and to induce thrombosis, they have different roles in inflammation, atherosclerosis, angiogenesis, antimicrobial host defense, and contribution to wound healing [1-4]. Activated PLTs can promote vascular inflammation, causing endothelial inflammation and subsequent leukocyte extravasation via their stored cytokines and chemokines [1,4]. Over the last few years, several new and reportable parameters have been used in the routine complete blood count (CBC) analyzers [5]. Automated blood cell counters provide a platelet count and derive indices relating to the size of platelets. Size-related parameters are derived from the impedance platelet size distribution curve. Mean platelet volume (MPV) is calculated by dividing the plateletcrit (PCT) by the number of platelets, and therefore PCT is analogous to the red cell haematocrit. MPV is a potential marker of the platelet reactivity [6]. The platelet distribution width (PDW) is the width of the size distribution curve in femtoliter (fL) at the 20% level of the peak on the impedance platelet size distribution curve [5,7]. Variation in platelet size is indicative of change in platelet function. Therefore platelet parameters are markers that are thought to be increased in response to systemic inflammation, and various studies have stated the relationship between these parameters and different inflammatory disease [7,8]. Although high platelet count is not considered as an infection marker, some studies have suggested that infections may cause thrombocytosis [9,10]. For this reason, we aimed in this study to investigate the relationship between leukocyte count (white blood cell count, WBC) in conditions of infections being able to be treated with simple methods. However, some recently-published studies evaluating the relationship between these parameters and various conditions, including coronary artery disease [6], endometriosis [13], cerebral infarction [14] diabetes mellitus [15,16], pulmonary tuberculosis [17,18], and inflammation [8,12].

Our results showed that PLT counts and PLT parameters can probably be used as adjunct to clinical evaluation of infectious circumstances. PLTs have not only hemostatic functions but also are considered as inflammatory anucleate cells because many studies demonstrated that PLT counts and PLT parameters are strongly associated with inflammatory and infectious conditions [1,2,11,12]. In the present study, we found that the PLT counts and PCT values significantly increased in Group 2 when compared with normal WBC count Group 1. In addition, we have found that MPV and PDW values were not significantly different in both groups. PCT, MPV and PDW values in CBC results are not usually considered in daily practise by clinicians. However, there are some recently-published studies evaluating the relationship between these parameters and various conditions, including coronary artery disease [6], endometriosis [13], cerebral infarction [14] diabetes mellitus [15,16], pulmonary tuberculosis [17,18], and inflammation [8,12].

Discussion

This study was aimed to demonstrate that PLT counts and PLT parameters can probably be used as adjunct to clinical evaluation of infectious circumstances. PLTs have not only hemostatic functions but also are considered as inflammatory anucleate cells because many studies demonstrated that PLT counts and PLT parameters are strongly associated with inflammatory and infectious conditions [1,2,11,12]. In the present study, we found that the PLT counts and PCT values significantly increased in Group 2 when compared with normal WBC count Group 1. In addition, we have found that MPV and PDW values were not significantly different in both groups. PCT, MPV and PDW values in CBC results are not usually considered in daily practise by clinicians. However, there are some recently-published studies evaluating the relationship between these parameters and various conditions, including coronary artery disease [6], endometriosis [13], cerebral infarction [14] diabetes mellitus [15,16], pulmonary tuberculosis [17,18], and inflammation [8,12].

These findings show that a linkage of PLT indices is present not only in simple but also in severe infections, and these indices can thus be
used for daily clinical practise. In any simple and severe infectious circumstance, the decision for clinical treatment depends on a variety of clinical and laboratory data, and each data can be used for management of this infectious state and prediction of the prognosis. There is a well-known close relationship between leukocytes and platelets especially in inflamed endothelium [4,19]. Leukocytes can roll on a template of adherent platelets, firmly adhere, and then transmigrate through the adherent platelets [19].

It is thought that PLTs are one of the first responding anucleate cells during the development of sepsis. Platelet activation readouts have been suggested as biomarkers for the development of septic complications and have been related to prognosis [20]. Although the changes in PLT count are common during sepsis [21], the relation of leucocytes to platelets is not clear in simple bacterial and viral infections. In addition, it has been reported that leukocytosis is a risk factor for thrombosis in polycythemia vera and essential thrombocythemia [22,23], and leukocytosis is an independent, strong risk factor predicting major vascular events in essential thrombocythemia, particularly in the category of the younger and asymptomatic patients [22].

**Conclusion**

PLT count and PCT values increase in infectious conditions. This study and previous studies show that PLTs are employed in infectious conditions but the exact mechanism and the exact clinical importance of this response remains to be cleared by further studies. Our study has a limitation that number of patients and controls were small.

**What is known about this topic**
- MPV is usually increased in infectious conditions;
- PLT and PCT count are not usually altered in infectious conditions.

**What this study adds**
- PLT count is increased in leukocytosis caused by infectious conditions;
- MPV isn’t changed in leukocytosis caused by infectious conditions.

**Competing interests**

No competing interest.

**Authors’ contributions**

Nurinnisa Ozturk contributed to conception and design, analysis and interpretation of data, drafted the article and prepared final approval of the version to be published; Ebu Bebekir Bakan contributed to conception and design, drafted the article and prepared final approval of the version to be published; Gulsum Feyza Altas analysed and interpreted the data; Nurcan Kilic Baygutalp analysed and interpreted the data; Emrullah Dorman analysed and interpreted the data.

**Tables and figures**

Table 1: WBC, PLT, MPV, PDW, and PCT values in two groups

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**Figure 1**: The scatter plot of PLT counts and WBC counts in group 1 (WBC counts within reference range) (p=0.000, r=0.055)

**Figure 2**: The scatter plot of PLT counts and WBC counts in group 2 (WBC counts higher than upper limit of reference range) (p=0.019, r=0.013)
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| Parameters | Group 1 (n=341) | Group 2 (n=327) | p and z values |
|------------|---------------|---------------|---------------|
|            | Mean±SD       | Min-Max       | Mean±SD       | Min-Max       |               |
| WBC(*10³/µL) | 7.51±1.32     | 5.00-9.90     | 14.19±2.89    | 11.00-20.00   | p=0.000* z=-22.364 |
| PLT(*10³/µL) | 230±59.1      | 150-450       | 263±89.6      | 150-590       | p=0.000* z=-4.243 |
| MPV(fL)    | 8.26±0.93     | 6.60-10.90    | 8.22±0.97     | 6.60-10.90    | p=0.444 z=-0.766 |
| PCT (%)    | 0.18±0.04     | 0.10-0.45     | 0.21±0.07     | 0.10-0.54     | p=0.000* z=-4.586 |
| PDW (%)    | 16.84±0.69    | 14.60-19.70   | 16.89±0.71    | 14.90-19.70   | p=0.603 z=-0.520 |

WBC: white blood cell count, PLT: platelet count, MPV: mean platelet volume, PDW: platelet distribution width, PCT: plateletcrit count, p: test statistic p value, z: test statistic z value, SD: Standard deviation, *: Statistically significant p value
Figure 1: The scatter plot of PLT counts and WBC counts in group 1 (WBC counts within reference range) ($p=0.000$, $r^2=0.055$)

Figure 2: The scatter plot of PLT counts and WBC counts in group 2 (WBC counts higher than upper limit of reference range) ($p=0.019$, $r=0.013$)