Mean Platelet Volume, Platelet Distribution Width and Platelet-crit Values in Differentiating Clonal from Secondary Thrombocytosis

Khaleed Jumaa Khaleel(a)  Abeer Anwer Ahmed(b)  Maysem M. Alwash(b)  Nahi Yousif Yasin(a)

(a) Iraqi Centre for Cancer Research and Medical Genetics, Baghdad, Iraq.
(b) Dept. of Pathology, College of Medicine, Al-Mustansiriyah University, Baghdad, Iraq.

Abstract

Objective: To assess whether platelet indices (platelet count, mean platelet volume (MPV), platelet distribution width (PDW)) and platelet-crit (PCT) could serve as diagnostic tools to differentiate between primary and secondary thrombocytosis.

Subjects and Methods:
A total of 83 Iraqi patients with thrombocytosis attending the Iraqi centre for cancer research & medical genetics and the National Iraqi Centre for Blood Diseases were included in this prospective case series study. A group of 20 healthy persons were included as a control. Complete blood count was done using Mindwayhaematologicautoanalyser.

Results: Mean platelet volume, platelet distribution width & platelet-crit in primary thrombocytosis were significantly higher than in secondary thrombocytosis. In primary thrombocytosis group platelet count inversely correlate with both Hb & MCV, while in secondary thrombocytosis platelet count inversely correlates with MCV only but less significantly than the correlation found in primary thrombocytosis.

Conclusions: MPV, PDW and PCT can be used as helpful parameters in the differential diagnosis of thrombocytosis.

الخلاصة

أهداف البحث:
تم اجراء هذه الدراسة لمعرفة فيما اذا كان المؤشرات التقدميّة للفئات الدموية: الطيف التوزيعي للاقراس، معدل حجم الاقراص والبميتكرت يمكن أن تكون بمثابة أدوات التشخيص التمييز بين زيادة (فرط) الاقراص الأولي نتيجة اعتلال نخاعي أولي وزيادة الاقراص نتيجة اسباب ثانوية.

طريقة البحث:
شملت هذه الدراسة المستقبليّة 83 مريضاً مصابين بزيادة (فرط) الاقراص الدموية من مراجعي المركز الوطني للاعراض الدم والمركز العراقي لبحوث السرطان والوراثة الطبية، وتم اجراء الفحوصات المتعمقة بالاقراص الدموية باستخدام الجهاز الالكتروني. وشملت الدراسة 20 شخصاً طبيعياً لديهم عدد طبيعي من الاقراص الدموية للمقارنة.

النتائج:
وجد أن هناك اختلاف واضح ذو أهمية في المؤشرات المتعلقة بالاقراص الدموية بين المرضى المصابين بزيادة الاقراص نتيجة اعتلال نخاعي أولي وزيادة الاقراص نتيجة اسباب ثانوية. حالياً، فإن الطيف التوزيعي للاقراص الدموية معدل حجم الاقراص والبميتكرت يمكن أن يلعب دوراً في التشخيص التفريقي في حالات زيادة الاقراص الدموية.

الاستنتاج:
إن المؤشرات المتعلقة بالاقراص الدموية يمكن أن تعتبر مؤشراً ذو أهمية للتشخيص التفريقي في حالات زيادة الاقراص الدموية بنوعه.
Introduction

Thrombocytosis is an increased platelets count[1] which is usually discovered as an incidental laboratory abnormality when the complete blood count is obtained for some unrelated reason. When found, however, it creates an important diagnostic challenge [2]. Generally thrombocytosis is either a reactive process (secondary thrombocytosis), which occurs secondary to a variety of acute and chronic clinical conditions including: acute infection or inflammation, response to exercise, acute blood loss, iron deficiency, postsplenectomy, malignancy, chronic inflammatory and infectious diseases. response to drugs like vincristine and epinephrine and haemolytic anaemia or it is autonomous caused by a clonal bone marrow disorders including essential thrombocythemia and other myeloproliferative disorders.[2,3]

Differentiating clonal from secondary causes of thrombocytosis can be extremely difficult, yet the distinction has important therapeutic implications. Secondary thrombocytosis per se does not result in vascular or hemostatic problems, but its underlying cause must be identified and treated, if possible. In contrast, clonal thrombocytosis (essential thrombocythemia and the other, related chronic myeloproliferative disorders) is associated with thrombotic and bleeding complications.[2]

Automated hematological analyzers have contributed to precise and fast results. They also make it possible to measure several blood cell parameters automatically. Among the parameters provided, platelet indices are probably the most ignored by clinical laboratories due to the difficulty of standardization, as well as being affected by a range of methodological problems.[4]

The platelet parameters that have been investigated in our study include:

- Mean platelet volume (MPV): mean platelet volume (MPV) is a measurement that describes the average size of platelet cells in the blood.[5]
- The platelet distribution width (PDW): is a measure of platelet anisocytosis.[6]
- The plateletcrit: is the product of the MPV and platelet count and, by analogy with the haematocrit, maybe seen as indicative of the volume of circulating platelets in a unit volume of blood.[6]

Aim of the Study

is to investigate whether platelet indices [platelet count, mean platelet volume (MPV), platelet distribution width (PDW)] and plateletcrit(PCT)] could serve as diagnostic tools to differentiate between primary and secondary thrombocytosis.

Subjects and Methods

A total of 83 Iraqi patients (38 males and 45 females) with thrombocytosis, platelets count more than 400×10⁹/l attending the Iraqi centre for cancer research & medical genetics and the National Iraqi Centre for Blood Diseases were included in this prospective case series study, their age range was (20-63 yr). A group of 20 healthy person (age & sex matched) were included as a control.

These patients were subjected to the followings:

1. Complete blood count using mind way haematologic auto analyser.
2. Peripheral blood film .
3. Bone marrow aspirate ± bone marrow trephine biopsy when indicated.

Computerized statistical analysis was performed using SPSS (statistical package of social sciences), version 17. The statistical significance of difference was assessed using
independent t test & correlation study. P value less than 0.05 was considered indicative of statistically significant difference.

Results
According to aetiology, Patients were divided into two main groups:

Table 1 classification of patients according to the cause of thrombocytosis.

<table>
<thead>
<tr>
<th>Group (1)</th>
<th>No. of cases</th>
<th>Group (2)</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary thrombocytosis:</strong></td>
<td>12</td>
<td><strong>Secondary(reactive) thrombocytosis:</strong></td>
<td>71</td>
</tr>
<tr>
<td>1-Essential thrombocythemia.</td>
<td>2</td>
<td>1-iron deficiency anaemia.</td>
<td>24</td>
</tr>
<tr>
<td>2-polycythemia vera.</td>
<td>4</td>
<td>2-infection.</td>
<td>19</td>
</tr>
<tr>
<td>3-chronic myeloid leukemia.</td>
<td>6</td>
<td>3-non hematological neoplasm.</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-haemolysis</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-postoperative</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6- collagen diseases</td>
<td>1</td>
</tr>
</tbody>
</table>

Patients with reactive thrombocytosis (85.5%) represent the higher percentage of patients with thrombocytosis, while cases with primary thrombocytosis contribute to 14.5% of total patients. Mean platelet volume, platelet distribution width & plateletcrit in primary thrombocytosis were significantly higher than in secondary thrombocytosis, p value less than 0.05, as summarized in table (2)
Table 2 Mean values of different platelet indices & P-value in primary & secondary thrombocytosis.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Primary thrombocytosis</th>
<th>Secondary thrombocytosis</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelet count ×10^9/L</td>
<td>691.92±270.53 (409.0-1260.0)</td>
<td>526.97±108.28 (402.0-953.0)</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean platelet volume (fimtoliter) MPV</td>
<td>11.05±2.74 (8.2-15.5)</td>
<td>9.28±1.14 (7.6-15.4)</td>
<td>0.001</td>
</tr>
<tr>
<td>Platelet distribution width PDW (fimtoliter)</td>
<td>14.81±0.37 (14.2-15.6)</td>
<td>13.73±1.14 (11.1-15.3)</td>
<td>0.002</td>
</tr>
<tr>
<td>Plateletcrit% PCT</td>
<td>1.29±2.66 (0.02-9.7)</td>
<td>0.47±0.09 (0.28-0.68)</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Data were presented as Mean ± SD (Range).

MPV correlates significantly with both platelet count & PCT (P-value < 0.05, r = 0.848 and 0.415 respectively) in primary thrombocytosis. The same correlations are also found in secondary thrombocytosis, (P-value < 0.05, r = 0.298, 0.415 respectively). In primary thrombocytosis group platelet count inversely correlate with both Hb and MCV, while in secondary thrombocytosis although no correlation was found between platelet count & Hb, platelet count inversely correlates with MCV but less significantly than the correlation found in primary thrombocytosis, as summarized in table 3 and 4.

Table 3 The correlation of platelets count with Hb & MCV in primary thrombocytosis.

<table>
<thead>
<tr>
<th>Platelet count</th>
<th>Hb</th>
<th>MCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>0.629-</td>
<td>0.873-</td>
</tr>
<tr>
<td>p</td>
<td>0.092</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 4 The correlation of platelets count with Hb & MCV in secondary thrombocytosis.

<table>
<thead>
<tr>
<th>Platelet count</th>
<th>Hb</th>
<th>MCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>0.195-</td>
<td>0.262-</td>
</tr>
<tr>
<td>p</td>
<td>0.104</td>
<td>0.027</td>
</tr>
</tbody>
</table>

Discussion
As multiple causes may be involved in thrombocytosis, differential diagnosis is not always obvious. Moreover, the available means to differentiate primary from secondary causes are not specific enough. Some authors tried to distinguish thrombocytosis in primary thrombocytosis from reactive thrombocytosis by using platelet parameters provided by blood analyzers[7]. The present study was
designed in an attempt to characterize the different thrombocytosis states by platelet parameters (MPV, PDW, PCT). The finding of thrombocytosis in the majority (85.5%) of cases studied was in the context of secondary (reactive) thrombocytosis with iron deficiency anaemia & infection representing the most common causes. Similar results were obtained by Mata et al [8]. By far the most common cause of thrombocytosis in general medical populations is a reactive, or secondary, process. The degree of elevation in the platelet count does not clearly differentiate clonal from reactive thrombocytosis [2].

Mean platelet count was significantly higher in primary than in secondary thrombocytosis, similar results were obtained by Selami Kocak et al. [9]. We observed that MPV was significantly higher in primary thrombocytosis than in reactive thrombocytosis. Similar results were reported by Osselaer et al. [7]. This significant increase in MPV may contribute at least partly to the increase in thrombotic complication seen in primary thrombocytosis as larger platelets are enzymatically and metabolically more active and have a higher potential thrombotic ability as compared with smaller platelets [10].

Primary thrombocytosis group show significantly higher level of PDW than secondary thrombocytosis; In primary thrombocytosis, the blood film shows a thrombocytosis with varying degrees of platelet anisocytosis. Platelet morphology can vary from those of normal size and granularity to larger atypical forms [11].

As MPV correlates significantly with both platelet count and PCT in primary as well as secondary thrombocytosis groups, we cannot depend on this relation to differentiate between primary and secondary thrombocytosis. The MPV is generally increased in the myeloproliferative disease [12]. However, there is a nonlinear inverse relationship between the MPV and the PLT count within normal individual [13].

In primary thrombocytosis group, platelets count also shows an inverse correlation with Hb and MCV. In a study by Abdulkarim et al. from Sweden, it was found that the only independent parameter affecting survival was lower Hb, also a higher transformation risk into acutemyeloid leukemia was associated with a lower Hb level [14].

**Conclusions**

MPV, PDW and PCT can be used as helpful parameters in the differential diagnosis of thrombocytosis, so more attention should be directed towards these parameters and their role in the differential diagnosis of thrombocytosis.

**References**


