Utility of Platelet Indices (Pi) In Thrombocytopenia - An Institutional Based Two Years Clinicopathological Study

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Abstract
INTRODUCTION: Automated hematology analyzers that determine the Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit (PCT), Platelet Large Cell Ratio (P-LCR) which could be very helpful to facilitate the differential diagnosis of thrombocytopenia and to monitor thrombocytopenic conditions.
AIMS AND OBJECTIVES: Deriving the cause of the thrombocytopenia by clinical and also by measuring the platelet indices.
MATERIALS AND METHODS: Prospective observational study of 3,864 thrombocytopenic samples of hemogram analysis by automated haematology analyzers and Static analysis was done.
RESULTS: Among the 3,864 cases of thrombocytopenia who were classified into hypoplastic (874 cases) and hyperdestructive (2,990) group. Most common cause of hypoplastic and hyperdestructive was Megaloblastic anaemia(10.9%) and Dengue(30.2%) respectively.
CONCLUSION: Platelet Indices were easy to measure and give a clue to aetiology of thrombocytopenia and it is also very cost effective.
Key Words: Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit (PCT), Platelet large cell ratio (P-LCR).

I. Introduction
Thrombocytopenia is a common clinical syndrome defined as platelet count below 1.5 lakh per microlitre of blood. During evaluation of thrombocytopenia, it is essential to identify the aetiology, whether it is due to hypoplastic or hyperdestructive which will have major impact on the management.[¹, ², ³] Measuring various Platelet indices, such as Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit (PCT) and Platelet large cell ratio (P-LCR) along with a simple Complete blood count may provide some valuable information regarding the underlying mechanism and pathogenesis of thrombocytopenia.[⁴, ⁵] MPV measures the average size of platelets. PDW is a measure of variation platelet size. It is a coefficient of variation (CV) percentage. PCT is a measure of total platelet mass. P-LCR is the ratio of large platelets.

| Table 1 Normal reference ranges of Platelet Indices (Pl) |
|------------------|------------------|
| MPV              | 9.4–12.3 fl      |
| PDW              | 10.0%–17.9%      |
| PCT              | 0.22–0.24%       |
| P-LCR            | 15-30%           |

DOI: 10.9790/0853-1801052126  www.iosrjournals.org  21 | Page
II. Materials And Methods

Total of 35,958 samples were received for hemogram analysis in two years duration and analyzed on Auto haematology analyzer. Among 35,958 samples 3,864 cases were presented with thrombocytopenia and Plateletcrit (PCT), Platelet Distribution Width (PDW) and Mean Platelet Volume (MPV) and relevant clinical details of these thrombocytopenic patients were collected and Static analysis was done.

III. Results

Among the 3,864 cases of thrombocytopenia who were classified into hypo productive (874 cases) and hyper destructive (2,990) group. Male to female ratio in hypo production and hyper destruction group was 1:1.2 and 1:1.1 respectively. Most common age group in hypo production and hyper destruction group was 50-60 years and 20-30 years respectively. The mean platelet count in the hypo production group is $67.4 \pm 29.5$ and in the hyper destruction group is $69.5 \pm 28.4$. 

![Figure 1](image1.png) Normal platelet histogram

![Figure 2](image2.png) Hypo production histogram

![Chart 1](chart1.png) Mean MPV in hypoproduction and hyperdestruction
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Figure 3: Hyper destructive histogram

Chart 2: Mean PDW in hypoproduction and hyperdestruction

Chart 3: Mean PDW in hypoproduction and hyperdestruction

- Low platelet count
- High MPV 16.1E
- High P LCR 68 2%
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Chart 4 Mean P-LCR in hypoproduction and hyperdestruction

**Pie chart 1** Aetiological distribution of hypoproduction

- Megaloblastic anemia
- Aplastic anemia/Pancytopenia
- Leukemia and MDS
- Others

**Pie chart 2** Aetiological distribution of hyperdestruction

- Dengue
- ITP
- Sepsis
- DIC
- Chronic liver disease
- Malaria
- Others
IV. Discussion

Automated hematology analyzers determine MPV, PDW, PCT and P - LCR which has been correlated with several disease states.[5, 6]

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<tbody>
<tr>
<td><strong>Hypo production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPV</td>
<td>9.7 ± 0.9</td>
<td>8.5 ± 1.27</td>
<td>10.17 ± 1.3</td>
<td>8.14 ± 1.2</td>
</tr>
<tr>
<td>PDW</td>
<td>13.2 ± 2.3</td>
<td>14.10 ± 1.15</td>
<td>19.7 ± 5.4</td>
<td>18.6 ± 1.2</td>
</tr>
<tr>
<td>PCT</td>
<td>-</td>
<td>0.08 ± 0.12</td>
<td>0.06 ± 0.03</td>
<td>0.06 ± 0.01</td>
</tr>
<tr>
<td>P - LCR</td>
<td>25 ± 7</td>
<td>31.90 ± 3.46</td>
<td>-</td>
<td>14.4 ± 1.1</td>
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<tr>
<td><strong>Hyper destruction</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MPV</td>
<td>12.4 ± 3.6</td>
<td>11.6 ± 2.25</td>
<td>12.3 ± 0.9</td>
<td>12.4 ± 0.9</td>
</tr>
<tr>
<td>PDW</td>
<td>15.5 ± 3.2</td>
<td>15.16 ± 1.36</td>
<td>19.3 ± 4.2</td>
<td>20.4 ± 5.6</td>
</tr>
<tr>
<td>PCT</td>
<td>-</td>
<td>0.09 ± 0.14</td>
<td>0.08 ± 0.1</td>
<td>0.08 ± 0.01</td>
</tr>
<tr>
<td>P - LCR</td>
<td>36.8 ± 13</td>
<td>34.30 ± 0.14</td>
<td>-</td>
<td>45.6 ± 13.4</td>
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Table 2. Distribution and comparison of Platelet indices in thrombocytopenia with similar studies

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<tr>
<td>Aplastic anemia / Pancytopenia</td>
<td>-</td>
<td>12 (11.8%)</td>
<td>-</td>
<td>336 (9.2%)</td>
</tr>
<tr>
<td>Megaloblastic anemia</td>
<td>08 (8%)</td>
<td>4 (3.9%)</td>
<td>11 (9.2%)</td>
<td>422 (10.9%)</td>
</tr>
<tr>
<td>Leukemia and MDS</td>
<td>06 (6%)</td>
<td>22 (21.6%)</td>
<td>2 (1.7%)</td>
<td>31 (0.8%)</td>
</tr>
<tr>
<td>Others</td>
<td>-</td>
<td>-</td>
<td>13 (10.8%)</td>
<td>65 (1.7%)</td>
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<tr>
<td><strong>Hypo production Total cases (%)</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hyper destruction Total cases (%)</strong></td>
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MPV has an inverse relationship with platelet number volumes in thrombocytopenic patients due to peripheral destruction (Hyper destruction group) as in hyperdestruction like ITP, dengue, sepsis and myeloproliferative disorders etc.[6, 7, 8] Decreased MPV has been associated with megakaryocytic hypoplasia/hypoproduction.[9] High PDW has been associated with hyper destructive thrombocytopenia because of the release of heterogeneous population of platelets which vary in their size (anisocytosis).[10][11]

PCT value is not altered much by severity of thrombocytopenia of either hypo productive or hyper destructive aetiology because in healthy subjects platelet mass is closely regulated to keep it constant.[15]

P-LCR was increased in destructive thrombocytopenia patients compared with hypoproliferative thrombocytopenia and a good marker for aid in the differential diagnosis of conditions associated with abnormal platelet counts. [18]

References


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