Mean platelet volume in patients with inflammatory bowel disease

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Abstract

Background: Crohn’s disease (CD) and ulcerative colitis (UC) are main inflammatory bowel diseases (IBD) which show progression with remissions and exacerbations. Mean platelet volume (MPV) and inflammatory markers are affected in chronic inflammatory diseases. In this study we aimed to investigate MPV in patients with IBD.

Methods: A total of 200 subjects were enrolled. The study group consisted of 100 patients with IBD (UC: 50 and CD:50) and the control group included 100 healthy subjects. Groups were compared regarding MPV and CRP levels. The correlation between MPV and CRP was assessed.

Results: Groups were similar in terms of age, sex and MPV levels (p=0.09, 0.08, 0.459, respectively). CRP levels were higher in patients with CD (p<0.001). A significant correlation was found between MPV and CRP only in active CD patients (r=-0.527; p=0.009).

Conclusion: Although MPV was found to be associated with chronic inflammatory conditions, we did not show any association between inflammatory bowel disease.
subgroup was comprised of 50 patients with UC and the other one comprised of 50 patients with CD.

Diagnosis of IBD was mainly done according to clinical, endoscopic and pathologic criteria. The BMI was achieved from the records which had been calculated according to height and weight measurements for each individual at the time of admission. The blood sample results were recorded concurrently at the time when clinical activity indices of CD and UC patients were calculated. Control group was collected among healthy subjects who did not have a history of acute or chronic infection, endocrinological or hematological disease, heart failure, hepatic and renal disorder, cancer and peripheral vascular disease. None of the enrolled subjects had received any medication influencing biochemical tests.

Crohn’s Disease Activity Index (CDAI) and Modified Truelove Witts Activity Index (MTWAI) were used for evaluating clinical activities of CD and UC, respectively [12,13]. Complete blood counts were measured with the Sysmex XE 2100i (Japan) by fluorescence flow cytometry, ESR and CRP levels were determined using the Westergreen method and immuno turbidimetry, respectively. Body mass index was calculated according to the medical records achieved on admission for each individual. Disease Activity Index scores, hemoglobin, hematocrite, platelet count, MPV and CRP levels were recorded.

All analyses were performed using NCSS (Number Cruncher Statistical System) 2007 & PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA). Data are shown as mean ± standard deviation (SD). Besides descriptive analysis (mean, Standard error, frequency, ratio) ANOVA or Kruskal-Wallis tests were used to compare the quantitative measurements between the three groups. Students’ t test was used to compare variance between groups with normal distribution and Mann Whitney U test was used for comparing groups without normal distribution. Pearson or Spearman correlation analysis were used to show the correlation between MPV and other inflammatory markers. The probability of making a Type I error (alpha, significance) is 0.05 in all tests.

**Results**

Groups were similar in terms of age and sex (p=0.09 and 0.08, respectively). There were 26 women (52%) and 24 men (48%) in the CD group. The study group of patients with UC consisted of 19 women (38%) and 31 men (62%), while the control group of healthy participants contained 57 women (57%) and 43 men (43%). Both of the subgroups were comparable according to the frequency of active disease. Twenty-three out of 50 CD and 24 out of UC patients were at active disease period (p=0.842) (Table 1).

The MPV levels of the groups were statistically similar. The MPV levels of patients with CD, UC and healthy subjects were 7.76 ± 0.95, 7.76 ± 1.37 and 7.94 ± 0.82, respectively (p=0.459), Table 1. The serum CRP levels of the groups were statistically different. Patients with CD had highest CRP levels. The CRP levels of the patients with CD, UC and healthy subjects were 7.58 ± 3.7, 0.69 ± 0.87 and 0.33 ± 0.03, respectively (p<0.001) (Table 1). The blood hemoglobin levels, hematocrit percentages and platelet counts of the groups were also statistically different (p<0.001, <0.006, <0.001, respectively, Table 1).

The comparison of MPV and CRP values of the active and inactive CD patients did not show any significant difference (7.86 ± 0.92 vs. 7.64 ± 0.98, p=0.426, 0.68 ± 0.65 vs. 2.65 ± 4.76, p=0.126, respectively, Table 2). Platelet level of patients with active CD was higher than patients with inactive CD (p=0.012). The comparison of MPV values of the active and inactive UC patients also did not show any significant difference (8.07 ± 1.65 vs. 7.43 ± 0.91, p=0.101). On the other hand, there was a statistically significant difference between active and inactive UC patients according to the CRP levels (0.45 ± 0.37 vs. 0.96 ± 1.15, p=0.018, Table 3).

According to the Pearson correlation analyses; an inverse correlation was found between MPV and CRP (r = -0.527, p = 0.009, Table 4, Figure 1) in patients with CD. CRP levels were positively correlated with CDAI in patients with CD (r = 0.477, p = 0.004, Table 2). Platelet level of patients with active CD was higher than patients with inactive CD (p=0.012). The comparison of MPV values of the active and inactive UC patients also did not show any significant difference (8.07 ± 1.65 vs. 7.43 ± 0.91, p=0.101). On the other hand, there was a statistically significant difference between active and inactive UC patients according to the CRP levels (0.45 ± 0.37 vs. 0.96 ± 1.15, p=0.018, Table 3).

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**Table 1. The demographic and clinical features of the patients and controls.**

<table>
<thead>
<tr>
<th></th>
<th>Crohn's Disease (N=50)</th>
<th>Ulcerative colitis (N=50)</th>
<th>Control (N=100)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>36.48 ± 11.41</td>
<td>40.84 ± 12.93</td>
<td>37.52 ± 8.54</td>
<td>0.09</td>
</tr>
<tr>
<td>Body mass Index (kg/m²)</td>
<td>24.64 ± 6.12</td>
<td>24.88 ± 4.33</td>
<td>23.42 ± 2.84</td>
<td>0.083</td>
</tr>
<tr>
<td>Female (%)</td>
<td>26 (52%)</td>
<td>19 (38%)</td>
<td>57 (57%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Active Disease</td>
<td>23 (46%)</td>
<td>24 (48%)</td>
<td>---</td>
<td>0.842</td>
</tr>
<tr>
<td>Platelet (10³/µL)</td>
<td>316.66 ± 92.84</td>
<td>298.76 ± 76.17</td>
<td>265.68 ± 58.42</td>
<td>0.001</td>
</tr>
<tr>
<td>MPV (fL)</td>
<td>7.76 ± 0.95</td>
<td>7.76 ± 1.37</td>
<td>7.94 ± 0.82</td>
<td>0.459</td>
</tr>
<tr>
<td>CRP (mg/dL)</td>
<td>1.58 ± 3.37</td>
<td>0.69 ± 0.87</td>
<td>0.33 ± 0.03</td>
<td>0.001</td>
</tr>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>13.0 ± 2.1</td>
<td>13.2 ± 1.1</td>
<td>13.9 ± 1.2</td>
<td>0.001</td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>39.2 ± 5.9</td>
<td>39.6 ± 4.7</td>
<td>41.5 ± 3.7</td>
<td>0.006</td>
</tr>
</tbody>
</table>

**Table 2. Platelet, MPV and CRP levels of active and inactive CD patients.**

<table>
<thead>
<tr>
<th></th>
<th>Crohn’s disease (inactive)</th>
<th>Crohn’s disease (active)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelet (10³/µL)</td>
<td>285.78 ± 71.51</td>
<td>352.91 ± 103.00</td>
<td>0.012</td>
</tr>
<tr>
<td>MPV (fL)</td>
<td>7.86 ± 0.92</td>
<td>7.64 ± 0.98</td>
<td>0.426</td>
</tr>
<tr>
<td>CRP (mg/dL)</td>
<td>0.68 ± 0.65</td>
<td>2.65 ± 4.76</td>
<td>0.126</td>
</tr>
</tbody>
</table>

**Table 3. Platelet, MPV and CRP levels of active and inactive UC patients.**

<table>
<thead>
<tr>
<th></th>
<th>Ulcerative colitis (active)</th>
<th>Ulcerative colitis (inactive)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelet (10³/µL)</td>
<td>291.77 ± 69.44</td>
<td>306.33 ± 83.69</td>
<td>0.505</td>
</tr>
<tr>
<td>MPV (fL)</td>
<td>8.07 ± 1.65</td>
<td>7.43 ± 0.91</td>
<td>0.101</td>
</tr>
<tr>
<td>CRP (mg/dL)</td>
<td>0.45 ± 0.37</td>
<td>0.96 ± 1.15</td>
<td>0.018</td>
</tr>
</tbody>
</table>

**Discussion**

In this study we investigated the MPV levels in patients with IBD. UC and CD are two main inflammatory bowel diseases. While UC is limited to the colon, CD can involve any segment of the gastrointestinal tract. The clinical course of diseases is characterized by remission and relapse which may develop spontaneously or in response to medical treatment. Early diagnosis and treatment of active disease are important for reducing morbidity and mortality [14]. Many non-invasive tests have been studied for diagnosis and determining the activation degree of inflammatory bowel disease. Nevertheless, an ideal test has not been found yet. MPV is a measurement of the average size of platelets. MPV correlates with platelet function and activation. It can be influenced by the inflammation. Larger platelets which are metabolically and enzymatically more active used in inflammatory process [15].

We have shown that MPV levels are not affected by active and inactive CD and UC. We have also shown high CRP levels in patients with CD. Our results are in accordance with some of previous studies.
while there are also inconsistent results. Douda et al. compared MPV levels of active and inactive 56 CD patients and found that active CD patients had significantly lower MPV levels than inactive ones [16]. Zubcevic et al. studied on 36 CD patients and reported that MPV levels were associated with mild and moderate disease activity. In addition they also reported high CRP levels in CD patients [17].

We did not find any significant difference among MPV and CRP levels of active and inactive CD patients. Song Liu et al. demonstrated lower MPV levels in CD patients in their study that was conducted with 61 CD patients and 50 healthy controls in 2011 [12]. However, when CD patients were classified into two groups as active and inactive patients, the MPV levels were comparable with healthy controls. This study failed to demonstrate any correlation between MPV levels and other activity indices in CD patients as well, similar to our study.

In present study we have not found any difference between active and inactive UC patients according to the MPV levels. Conversely, CRP levels were high in patients with active UC. In addition no correlation was found between MPV and CRP in these patients. Kayhan et al. reported similar MPV levels in active and inactive UC patients [18]. On the other part, some of previous studies showed that active UC patients had lower MPV values than inactive ones and healthy controls [18-20]. We have found an inverse correlation between MPV and MTWAI in the current study. In accordance with this link Yuksel et al. showed a correlation between MPV and MTWAI in their study [18].

The present study had some limitations. First, it would have been beneficial if the sample size had been larger. Second, MPV and CRP levels could be compared with other inflammatory cytokins. Thirth, this is a retrospective study. The result of a prospective study with larger sample size may be more helpful.

In conclusion, new biomarkers are needed and searched for diagnosing and predicting active disease in many inflammatory diseases. Chronic inflammation in IBD leads to alterations in platelet number and morphology [21]. Being an inexpensive and feasible marker, studies have focused specifically on MPV [22]. Although most of the studies show that MPV changes in case of inflammation, it is still not accepted as a valid biomarker for diagnosis or follow ups of any inflammatory disease. According to the result of the current study we suggest that MPV could be hardly used as a marker in determination disease activity for both diseases.

Acknowledgements and conflict of interest

The authors declare that they have no conflict of interest.

Contribution details

T.S. (initials) contributed to concept, discussion and wrote manuscript. Ş.Ö.K. contributed to concept, design, discussion, analyzed data, edited and wrote the manuscript. C.E. researched data and contributed to discussion, concept and design. S.A. contributed to discussion, Z.S. contributed to discussion and wrote manuscript, S.K. contributed to discussion.
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