Effects of Vitamin B12 treatment on hematological parameters

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Abstract

Objectives: Vitamin B12 deficiency is not a rare condition in medical practice. There is not much data in literature about overlooked hemogram parameters (ie. red cell distribution width, mean platelet volume, platelet distribution width) in vitamin B12 deficiency. We aimed to compare pre and post treatment hematological parameters of patients with vitamin B12 deficiency in present retrospective study.

Methods: Patients with vitamin B12 deficiency included to the study. Age, gender, vitamin B12 levels and hematological parameters, such as, white blood cell count (WBC), neutrophil count (neu), lymphocyte count (lym), eosinophil count (eos), hemoglobin (Hb), hematocrit (Htc), mean corpuscular volume (MCV), red cell distribution width (RDW), platelet count (PLT), mean platelet volume (MPV) and platelet distribution width (PDW) were recorded.

Results: Pretreatment RDW (16.5±0.6) was significantly higher than in posttreatment (16.1±1) period (p=0.021). MPV was significantly lower in pretreatment period (8.5±1.1) than in posttreatment (9±1.1) period (p=0.025).

Conclusions: We suggest that RDW and MPV alterations begin in early stages of Vitamin B12 deficiency before development of cytopenias. However, to confirm our results, prospective studies with a larger cohort are needed.

Keywords: Vitamin B12 deficiency, red cell distribution width, mean platelet volume.

Introduction

Vitamin B12 deficiency is not a rare condition in medical practice. Prevalence of deficiency increases by age. Furthermore, smoking, alcohol abuse, parasitosis, and drugs (gastric acid suppressors, metformin) may cause vitamin B12 deficiency by reducing absorption from gastrointestinal tract (1-4).

Hematological abnormalities in vitamin B12 deficiency includes anemia, leukopenia, thrombocytopenia, however, they occur in later periods of the disease. An increase in mean corpuscular volume, and macrocytosis and hypersegmentation in neutrophils in peripheral blood smear may suggest the diagnosis. There is not much data in literature about overlooked hemogram parameters (ie. red cell distribution width, mean platelet volume, platelet distribution width) in vitamin B12 deficiency.

We aimed to compare pre and post treatment hematological parameters of patients with vitamin B12 deficiency in present retrospective study.

Materials and Methods

We obtained the laboratory data of 62 patients with vitamin B12 deficiency. Age, gender, vitamin B12 levels and hematological parameters, such as, white blood cell count (WBC), neutrophil count (neu), lymphocyte count (lym), eosinophil count (eos), hemoglobin (Hb), hematocrit (Htc), mean corpuscular volume (MCV), red cell distribution width (RDW), platelet count (PLT), mean platelet volume (MPV) and platelet distribution width (PDW) were recorded. Both pretreatment and posttreatment laboratory data obtained. Patients with concomitant other types of anemia (such as iron deficiency) were not included to the study. Also patients with missing laboratory data in posttreatment period were excluded.

Data was analysed with SPSS software (SPSS 15.0 for Windows, Chicago, IL, USA). Normally distributed variables conducted with student t test and non normally distributed parameters conducted with mann-whitney u test. Statistically significance set on p<0.05 level.

Results

We enrolled 62 patients to the study whose data were eligible for study protocol. 51 of the patients were female and 11 were male. Median age of study group was 23 (20-62) years. There was no statistically significant difference between pre and post treatment period in terms of WBC, neu, lym, eos, PLT and PDW levels (all p>0.05).
As expected, Vitamin B12 levels were significantly increased in posttreatment (559±259) period compared to pretreatment (186±40) period (p<0.001). In addition, mean Hb levels in pretreatment period (12.5±2gr/dl) was lower than of in posttreatment period (13.2±1.5gr/dl), however, the significance could not reach the statistically significance (p=0.06). Similarly, MCV in pretreatment period (87.4 ±5.4fL) was higher than in post treatment period (85 ±5.6fL), but, the difference was not significant either (p=0.09). Pretreatment RDW (16.5±0.6) was significantly higher than in posttreatment (16.1±1) period (p=0.021). MPV was significantly lower in pretreatment period (8.5±1.1) than in posttreatment period (9±1.1). The difference was also significant (p=0.025) (Table 1).

Table 1. Laboratory data of study cohort in pre and posttreatment period.

<table>
<thead>
<tr>
<th>parameter</th>
<th>Pre-treatment Mean ± Standard Deviation</th>
<th>Post-treatment</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC (u/mm$^3$)</td>
<td>6.46 ± 1.7</td>
<td>6.45 ± 1.6</td>
<td>0.98</td>
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<tr>
<td>Lym (u/mm$^3$)</td>
<td>1.98 ± 0.48</td>
<td>1.96 ± 0.55</td>
<td>0.84</td>
</tr>
<tr>
<td>Hb (g/dL)</td>
<td>12.6 ±2.1</td>
<td>13.2 ±1.6</td>
<td>0.06</td>
</tr>
<tr>
<td>Htc (%)</td>
<td>38 ±5.9</td>
<td>39.3 ±4.1</td>
<td>0.16</td>
</tr>
<tr>
<td>MCV (fL)</td>
<td>87.3 ±5.4</td>
<td>85.6 ±5.6</td>
<td>0.09</td>
</tr>
<tr>
<td>RDW(%)</td>
<td>16.5 ±0.6</td>
<td>16.1 ±1</td>
<td>0.021</td>
</tr>
<tr>
<td>PLT (u/mm$^3$)</td>
<td>272 ±82</td>
<td>268 ±65</td>
<td>0.80</td>
</tr>
<tr>
<td>MPV (fL)</td>
<td>8.5 ±1.1</td>
<td>9 ±1.1</td>
<td>0.025</td>
</tr>
<tr>
<td>VitB12 (pg/ml)</td>
<td>186 ±40</td>
<td>560 ±259</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Neu (u/mm$^3$)</td>
<td>3.8 (0.8-10)</td>
<td>3.9 (1.4-7.4)</td>
<td>0.61</td>
</tr>
<tr>
<td>Eos (u/mm$^3$)</td>
<td>0.1 (0-2.8)</td>
<td>0.1 (0-2.7)</td>
<td>0.57</td>
</tr>
<tr>
<td>PDW (%)</td>
<td>13.5</td>
<td>13.5</td>
<td>0.94</td>
</tr>
</tbody>
</table>

Discussion

We found that MPV and RDW were different in periods before and after Vitamin B12 treatment. Our study cohort was consisted of mild vitamin B12 deficiency therrorne, changes in Hb, MCV, WBC and PLT were not significant, however, alterations in RDW and MPV were revealed in early stages of vitamin B12 deficiency.

Mean corpuscular volume of the patients in pre and posttreatment period was not significantly different in our study. Authors speculate that MCV was an unreliable marker in vitamin B12 deficiency (5). Bor et al reported that only 2 of 98 patients with vitamin B12 deficiency had macrocytosis, which defined as a MCV value greater than 100fL (6). Kwok et al compared hematological parameters of patients with vitamin B12 to those of healthy controls and reported that WBC, MCV and PLT were not different between study groups (7). Similar to the literature, there was no statistically significant difference in Hb, Htc, WBC, and PLT levels between pre and post treatment periods, suggesting that, vitamin B12 deficiency was mild in our study population. Therefore, MCV has not been increased enough in pretreatment period.

Why MPV decreased after vitamin B12 treatment? We shall make some speculations about this topic. Vitamin B12 deficiency is associated with an elevation in serum levels of homocystine (8), which is considered as a risk factor for atherosclerosis (9). It is well established that atherosclerosis is characterized with subclinical inflammation, therefore, one can claim that, increased levels of homocystine are associated with inflammation. In addition, some authors reported that MPV was related with inflammatory conditions (10). In the lights of these findings, we think that vitamin B12 deficiency is a condition characterized with subclinical inflammation, thus, associated with alterations in MPV. A possible linkage between vitamin B12 deficiency and MPV may explain our results reporting a significant increase in MPV in post treatment period. Erythrocytes are tend to be greater in size in vitamin B12 deficiency, and similarly, it is expected that platelets should be greater in size too. In contrast, we found that MPV was lower in pre treatment period compared to post treatment period. Two possible mechanisms may interfere with the size of platelets. First, activated platelets in inflammatory conditions tend to be greater in size and they utilized in the process of inflammation and remaining inactive smaller platelets may cause a reduction in MPV value (10). Second, increased homocystein levels, which is associated with inflammation, may affect the production of platelets in bone marrow, alike other cytokines and inflammatory molecules (11).

A similar explanation may be possible for the significant difference in RDW. This erythrocyte parameter has been found to be associated with inflammatory diseases (12-14). Because vitamin B12...
deficiency should be considered as an inflammatory condition, changes in RDW should be expected. Furthermore, Pongstaporn et al found that RDW was significantly increased in patients with low Vitamin B12 levels (15). Similar to the literature, we showed that pre-treatment RDW was significantly increased compared to post-treatment RDW values.

Conclusion

In conclusion, we suggest that RDW and MPV alterations begin in early stages of Vitamin B12 deficiency before development of cytopenies. Therefore, monitoring MPV and RDW could be useful in patients with suspected vitamin B12 deficiency. However, to confirm our results, prospective studies with a larger cohort are needed.

References