Ann Med Res 2020;27(7):1977-81

Annals of Medical Research

DOI: 10.5455/annalsmedres.2020.01.025

Original Article

An evaluation of inflammation with mean platelet volume in children with celiac disease

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Abstract

Aim: The purpose of this study was to evaluate mean platelet volume and platelet distribution width in children with celiac disease.
Material and Methods: Fifty children with celiac disease (18 boys, 32 girls) and 63 healthy volunteer children (23 boys, 40 girls) were included in the study. Demographic features such as age, and gender and laboratory values such as platelet count, mean platelet volume, and platelet distribution width were recorded from the patients' files.
Results: Fifty children with celiac disease (18 boys, 32 girls) and 63 healthy volunteer children (23 boys, 40 girls) were included in the study. No statistically significant differences were determined between the celiac disease group and the healthy control group in terms of platelet counts (275,418±70,657/mm^3 and 280,888±61,290/mm^3, respectively, p=0.661), platelet distribution width (19.27±1.14 fL and 19.16±1.13 fL, respectively, p=0.670) or mean platelet volume (7.31±1.36 fL and 7.38±1.45 fL, respectively, p=0.779). At ROC analysis, a cut off value was determined for platelet distribution width of 18.2 fL with 24.00% sensitivity and 87.30% specificity (AUC: 0.504, 95% CI: 0.408-0.599 and p=0.947). A cutoff value for mean platelet volume of 0.74 was calculated with 72.00% sensitivity and 44.44% specificity (AUC: 0.520, 95% CI: 0.424-0.615 and p=0.708).
Conclusions: Mean platelet volume values in children with celiac disease were no different to those of the healthy control group. We think that the absence of any change in mean platelet volume, values in children diagnosed with celiac disease may be related to a short duration of inflammation.

Keywords: Child; celiac disease; inflammation; mean platelet volume

INTRODUCTION

Celiac disease (CD) is an immune-mediated disorder resulting in inflammation of and damage to the mucosa of the small intestine developing against the gluten contained in cereals (particularly wheat, rye, barley, and oats) in genetically predisposed individuals. Celiac disease emerges as the result of gluten-related damage to the mucosa of the upper small intestine (1). The role of exposure to environmental and other factors contributing to the disease in addition to gluten is not yet fully understood. The presence of leukocyte antigens DQ2 and/or DQ8 has been determined in more than 90% of cases of CD. The disease is one of the most common malabsorption disorders in childhood, with a prevalence of approximately 1% (2). Small intestine biopsy (SIB) is taken using the endoscopic method from patients in whom the disease is suspected based on clinical condition and serological test results, and diagnosis is made based on pathological examination (3). In addition to gastrointestinal system findings, CD may also manifest with findings such as refractory iron deficiency anemia, liver disease, dermatitis herpetiformis, alopecia, and enamel defect. A gluten-free diet is the only therapy available (4).

Mean platelet volume (MPV) is a routine complete blood count parameter, increased values being associated with platelet activation (5-6). Several studies have shown that MPV and platelet distribution width (PDW) may be of value in the diagnosis and treatment of clinical disorders (7). Platelets have been shown to play an important role in inflammation (8). Platelets contain various receptor series allowing them to interact with white blood cells, pathogens, tumor necrosis factor, interleukins and infected endothelium (9). Based on these findings, it has been suggested that MPV may be capable of use as a biomarker in inflammation (10).

Since CD is an inflammatory disease, we thought that platelets may have activated and thus MPV values may be affected in CD patients. To the best of our knowledge, no previous studies have investigated the relation between

Received: 09.01.2020 **Accepted:** 23.05.2020 **Available online:** 08.07.2020
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CD and MPV in children. The purpose of our study was to determine levels of the inflammation marker MPV in childhood CD.

MATERIAL and METHODS

This study was performed with 50 newly and previously diagnosed CD patients presenting to the Adıyaman Training and Research Hospital Pediatric Gastroenterology Department, Adıyaman, Turkey, between December 2017 and April 2018. Endoscopic upper gastrointestinal system examination was performed on children with clinically suspected CD and positive tissue transglutaminase values. Diagnosis was based on pathological examination of SIB specimens. Celiac disease cases with oncological, hematological, autoimmune or hepatic diseases, with accompanying acute or chronic infection, or using steroids were excluded from the study. Complete blood counts were performed with newly diagnosed patients at time of diagnosis, and at time of presentation for previously diagnosed cases. Leukocyte counts, hemoglobin (Hb) values, hematocrit (Hct) percentages, mean corpuscular volume (MCV) values, platelet counts, and MPV and PDW results were analyzed retrospectively. A control group was established consisting of healthy children attending the pediatric polyclinic for routine examination. Children with acute or chronic infection, with histories of oncological, hematological, autoimmune or hepatic diseases, diabetes mellitus, hypercholesterolemia, anemia, or hypertension, or with histories of drug use were not enrolled in the control group. The study was approved by the Local Ethical Committee (No. 2018/ 4-4 dated 05.04.2018) and was carried out in accordance with Declaration of Helsinki criteria. Informed consent forms were received from all patients or their relatives.

Complete blood count analyses of the patients and control groups were performed with the same device in our hospital. Analyses were carried out using a Cell-Dyn Ruby (Abbott Diagnostics, Santa Clara CA, USA) device within 2 h of blood specimen collection.

Statistical analysis

Statistical analyses were performed on SPSS 24 (Statistical Package for the Social Sciences) software. Categorical variables were expressed as number and percentage, and data were compared using the chi-square test. The Kolmogorov-Smirnov test was applied to determine whether continuous data exhibited normal distribution. Normally distributed continuous data were expressed as mean±standard deviation and were compared using the Independent Student t test. Receiver operating characteristic (ROC) curve analysis was applied to calculate optimal cutoff values for MPV and PDW in CD. P values < 0.05 were regarded as statistically significant.

RESULTS

One Celiac disease patient with type 1 diabetes mellitus and one with autoimmune thyroiditis were excluded from the research. Fifty CD patients (18 boys and 32 girls) and 63 healthy controls (23 boys and 40 girls) were thus finally enrolled in the study. No statistically significant difference was determined between the CD and control groups in terms of age or sex.

There was no statistically significant difference between the CD and control groups in terms of leukocyte values (p=0.292). Mean Hb values were 12.90±1.18 g/dL in the CD group and 13.45±0.71 g/dL in the control group (p=0.003). Mean Hct values were 39.23±3.44% in the CD group and 40.64±2.54% in the control group (p=0.013). Mean MCV values were 79.16±5.24 fL in the CD group and 81.20±3.98 fL in the control group (p=0.021). Hb, Hct, and MCV values were all lower in the CD group compared to the control group.

Table 1. Comparison of demographic characteristics and laboratory values of groups

	Patient group	Control group	P
Gender (Female/Male)	32/18	40/23	0.549
Age (year)	10.48±4.43	9.87±4.20	0.458
Leucocyte (/mm^3)	7.472±1.798	7.833±1.803	0.292
Hemoglobin (g/dL)	12.90±1.18	13.45±0.71	**0.003***
Hematocrit (%)	39.23±3.44	40.64±2.54	**0.013***
MCV (fL)	79.16±5.24	81.20±3.98	**0.021***
Platelet (/mm^3)	275.418±70.657	280.888±61.290	0.661
PDW (fL)	19.27±1.14	19.16±1.13	0.670
MPV (fL)	7.31±1.36	7.38±1.45	0.779

*P<0.05; MCV: Mean Corpuscular Volume; PDW: Platelet Distribution Width; MPV: Mean Platelet Volume

Mean platelet counts were 275,418±70,657/mm^3 in the CD group and 280,888±61,290/mm^3 in the healthy control group. No statistically significant difference was determined between the two groups' mean platelet counts (p=0.661). Mean PDW values were 19.27±1.14 fL in the CD group and 19.16±1.13 fL in the healthy control group (p=0.670). No statistically significant difference was determined between the two groups in terms of PDW. Mean MPV values were 7.31±1.36 fL in the CD group and 7.38±1.45 fL in the healthy control group (p=0.779). No statistically significant difference was determined between the two groups in terms of MPV (Table 1).

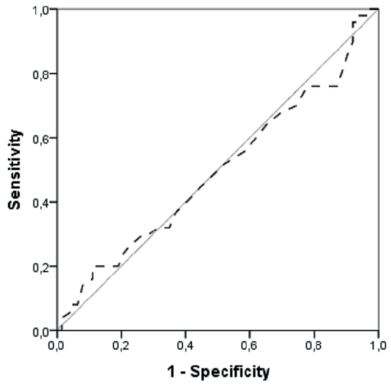

Figure 1. ROC curve of PDW for Celiac Disease

At ROC analysis, a cut-off value of 18.2 fL was determined for PDW, with 24.00% sensitivity and 87.30% specificity (AUC: 0.504, 95% CI: 0.408-0.599 and p=0.947) (Figure 1). A cut-off value of 0.74 fL was calculated for MPV, with 72.00% sensitivity and 44.44% specificity (AUC: 0.520, 95% CI: 0.424-0.615 and p=0.708) (Figure 2).

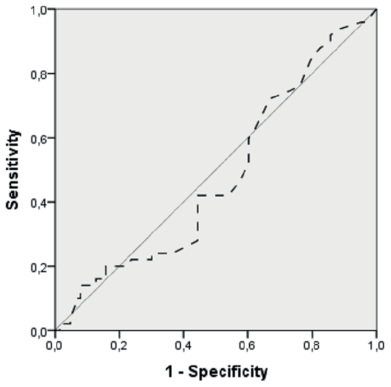

Figure 2. ROC curve of MPV for Celiac Disease

DISCUSSION

Celiac disease is a condition that develops with villous atrophy, crypt hyperplasia and lymphocyte infiltration in the small intestine against foods including wheat, rye, oats and barley in genetically susceptible individuals (11). The risk is greater in individuals with human leukocyte antigen DQ2 and/or DQ8 (12). The immunological reaction to gluten develops gradually and causes changes at the pathological level. The only known treatment for CD is a gluten-free diet (3). Histological improvement in the intestine occurs 6-12 months after adoption of a gluten-free regimen (13).

Platelets are cells that play important roles in physiological and pathological processes, such as coagulation, thrombosis, inflammation, and preserving the integrity of vascular epithelial cells, and that contain mediators that initiate a powerful inflammatory response. Platelets vary in terms of volume, density, age, and metabolic functions (5).

Mean platelet volume shows the mean volume of circulating platelets. Platelet distribution width, another index, indicates the difference between platelet diameters. Changes may be observed in both parameters when platelets are activated and change form. Mean platelet volume and PDW are therefore regarded as useful tools for the diagnosis and treatment of several inflammatory diseases. An increased platelet count and increased enzymatic activity are associated with systemic inflammation in rheumatic disease (14). Mean platelet volume is an important marker of platelet activation and function involved in inflammatory diseases. Our review of the literature revealed that MPV has been investigated in different disease groups and that differing results have been obtained. For example, juvenile idiopathic arthritis is a chronic inflammatory autoimmune rheumatic disease in children and adolescents. Gunes et al. determined an increase in MPV in the active phase of the disease in patients with juvenile idiopathic arthritis (15). Similarly, another study reported an increase in MPV in adult patients with ulcerative colitis, like Crohn's disease, an inflammatory bowel disease (16). In addition, increases have been shown in active phases in psoriasis (17), a progressive disease involving periods of attack and remission caused by autoimmune-mediated mechanisms, ankylosing spondylitis (18), and systemic lupus erythematosus (19), a multisystemic disease of uncertain etiology characterized by a high level of circulating autoantibodies. Infectious diarrhea is the most common cause of morbidity and mortality, particularly in children under the age of five. Rotavirus diarrhea is the leading cause of infectious diarrhea in children worldwide. Çelik et al. observed lower MPV values in children with rotavirus diarrhea compared to healthy children (20). Similarly, Ergül et al. determined a lower MPV value in children with acute bronchiolitis compared to healthy children (21). On the basis of these studies, it appears that both high and low MPV values may be of prognostic value for different disease conditions.

Purnak et al. showed that MPV values increased before treatment in adult age group CD patients, but that these returned to normal values after treatment (22). To the best

of our knowledge, no previous studies have examined platelet values in pediatric CD. Our study revealed no statistically significant difference between children with CD and healthy children in terms of platelet counts and MPV or PDW values. Cut-off values determined for PDW and MPV at ROC analysis exhibited low sensitivity and specificity. Our study is the first in the literature to investigate MPV values in children with CD.

Malnutrition and anemia associated with changed in small intestine mucosa are frequently seen in CD. Refractory iron deficiency anemia is particularly common (4). Studies have investigated changes in platelet parameters in children and adults with iron deficiency anemia and have concluded that these are significantly affected (23). The present study determined lower Hb, Hct and MPV values in the CD group. However, we determined no statistically significant difference in these values and platelet values compared to the control group.

The limitations of this study are its retrospective nature and the relatively small patient number involved.

CONCLUSION

In conclusion, we determined no change in platelet count or MPV and PDW values in children with CD compared to the healthy control group. We think that MPV values being within normal ranges in children diagnosed with CD may be associated with the brief duration of inflammation. Further studies with a larger patient population are required to establish the exact role of MPV values in patients with CD.

Competing interests: The authors declare that they have no competing interest.

Financial Disclosure: There are no financial supports.

Ethical approval: The study protocol was approved by the Institutional Ethics Committee of Adiyaman University Faculty of Medicine (No. 2017/5-3, dated 20.06.2017).

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