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Is the change in platelet parameters in children with allergic rhinitis an indicator of allergic inflammation?

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Abstract

It was aimed to find out whether MPV can be used as an indicator of allergic inflammation in children with allergic rhinitis by looking at the changes in MPV and MPV/Plt in this study. Pediatric patients between the ages of 6 and 18 who had a diagnosis of allergic rhinitis were included in the study. Sex- and age-matched healthy children who visited the outpatient clinic for routine controls were included as control in order to compare the changes in patients' total blood count parameters (e.g.,WBC, Hb, RDW, PLT, PDW, MPV). 95 pediatric (50 male, mean age:120 months) patients and 90 healthy children (38 male, mean age:120 months) were included in the study. There were no statistical differences between gender (p=0.15) and ages (p=0.33) of both groups. WBC (p=0.21), Hb (p=0.8), RDW values (p=0.3) and platelet numbers (p=0.05) of both groups were similar. In the allergic rhinitis group, mean MPV value (p<0.001), mean PDW value (p=0.005) were lower and mean Plt/MPV rate was higher (p=0.001). In addition, no significant association was found between the severity of allergic rhinitis and MPV (p=0.61). MPV value of 7.0 fL was identified as the cut off value at diagnosis with a sensitivity of 51.6 % and specificity of 83.3 % (AUC = 0.716; p=0.001). MPV values decrease in children with allergic rhinitis and MPV value is smaller than 7 fl is specific for allergic rhinitis.

Keywords: Allergic rhinitis, children, mean platelet volume

Introduction

Allergic rhinitis is an inflammatory disease that causes symptoms such as nasal flow, nasal congestion, itch and sneeze and it is estimated to affect almost 20-40% of the world population [1]. Allergic rhinitis can typically be defined as Ig E mediated hypersensitivity reactions that develop as a response to inhaled allergen. In allergic rhinitis, various cells such as eosinophils, mast cells, T lymphocytes and thrombocyte and the mediators released from these cells are responsible for the inflammation that occurs in the nasal mucosa as a result of exposure to allergen [1,2]. The allergic reactions that develop cause a remodeling in the form of changes in nasal mucosa epithelium, changes in extracellular matrix and increases in angiogenesis. Studies conducted with animal models have shown that thrombocyte activated in the remodeling caused by the migration of lymphocyte and eosinophils in the airway and the mediators released by these thrombocytes have been shown to have a significant role in allergic inflammation [3,4]. Mediators such as soluble P-selectin, Beta thromboglobulin and Platelet Factor-4 are released in activated thrombocytes and changes occur in platelet size [Mean platelet volüme (MPV)] [5-8]. The objective of the study is to find out whether MPV can be used as an indicator of allergic inflammation in children with allergic rhinitis by looking at the changes in MPV and Mean platelet volume /Platelet (Plt).

Material and Methods

We studied children aged between the 6-18 years old who had been diagnosed with allergic rhinitis at the Pediatric Allergy and Asthma Department of Inonu University Faculty of Medicine, and Ondokuz Mayıs University Faculty of Medicine, Turkey, between April and July 2015. Each patient diagnosed with allergic rhinitis undergoes total blood count, serum total Ig E level and skin prick test. The files of patient with allergic rhinitis whose information were complete were analyzed retrospectively. Gender, age, complaint and symptoms, the severity and character of allergic rhinitis, allergen sensitivity, serum total Ig E level and familial atopic disease history were recorded from the files of each patient.

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Sex- and age-matched healthy children who visited the outpatient clinic for routine controls and who did not have any acute and chronic illnesses were constituted as control group in order to compare the changes in patients' total blood count parameters [e.g., White blood cell (WBC), Hemoglobin (Hb), Red cell distribution width (RDW), PLT, Platelet distribution width (PDW), Mean platelet volume (MPV)]

Allergic rhinitis diagnosis was conducted according to the ARIA [1]. Also, the classification (seasonal & perennial) and severity (mild, moderate-severe) of allergic rhinitis was conducted according to ARIA guideline.

Exclusion criteria

The patients who had atopic disease besides allergic rhinitis (such as asthma, atopic eczema, food allergy) and sinusitis were not included in the study. Also, the patient who received treatment such as anti-histamine and /or nasal steroid was not included in the study. The patients who had factors that can affect MPV such as obese patients, patients with exposed to smoke and patients with autoimmune diseases (such as ulcerative colitis, rheumatoid arthritis) and had acute infection disease were not included in the study. The factors as sex and age may affect the MPV, therefore sex- and age-matched healthy children were used as control group.

Statistical analysis

The comparison of MPV value for patient and control group, to determinate of one unite differences between the groups, 95% confident intervals with 90 % power, minimum 86 cases were calculated that included in the current study. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) 15.0 software (SPSS Inc., Chicago, IL, United States). Descriptive statistics were expressed as frequency and percentage for categorical variables, whereas quantitative data were expressed as median for non-normally distributed data and as mean for normally distributed data. Mann-Whitney U test and unpaired t test were used to compare two groups (allergic rhinitis group and healthy child group), and Chi-square test was used to compare the categorical variable. ROC analysis was performed for cut-off values of MPV for allergic rhinitis. A two-sided $p < 0.05$ was considered as statistically significant. Approval was taken from the local ethical board of Inonu University Faculty of Medicine for the study.

Results

95 children (50 male, median age: 120 months) diagnosed with allergic rhinitis and 90 healthy children (38 male, median age: 120 months) were included in the study. There were no statistical differences between gender (p=0.15) and ages (p=0.33) of both groups. Demographic features of the patients diagnosed with allergic rhinitis are summarized in table 1. WBC (p=0.21), Hb (p=0.8), RDW values (p=0.3) and platelet numbers (p=0.05) of both groups were similar. In the allergic rhinitis group, mean MPV value (p<0.001), mean PDW value (p=0.005) were lower and mean Plt/MPV rate (p=0.001) was higher (Table 2). In addition, no significant association was found between the severity of allergic rhinitis and MPV (p=0.61). MPV value of 7.0 fL was identified as the cut off value at diagnosis with a sensitivity of 51.6 % and specificity of 83.3 % (AUC = 0.716; p =0.001) (Figure 1).

Table 1. Demographic data of patients who diagnosed allergic rhinitis (n: 95)

Variable	n (%)
Male	50 (45)
Age, median,(min-max), month	120 (54-204)
Symptoms of rhinitis	
Sneezing	90 (94.7)
Itching	67 (70.59)
Obstruction	69 (72.6)
Rhinorrhea	71 (74.7)
Conjunctivitis	55 (57.9)
Severity of allergic rhinitis	
Mild	41 (43.2)
Moderate-severe	54 (56.8)
Characteristics of allergic rhinitis	
Seasonal	62 (65.3)
Perennial	33 (34.7)
Skin prick test	
Dust mite sensitivity	16 (16.8)
Pollens sensitivity	50 (52.6)
Dust mite+pollen sensitivity	29 (30.5)
Serum Total Ig E level	148 (2.34-1310)
Peripheral eosinophilia	35 (36.8)
Atopy in family	57 (60)

Table 2. Differences of complete blood count parameters between the children with allergic rhinitis group and healthy group

Variable	Allergic rhinitis group (n:95)	Control group (n:90)	p-value
WBC, mean ±SD, $10^3/\mu L$	7.3 ±2.0	7.0±1.5	0.21
Hemoglobin, mean ±SD, mg/dL	13.1±1.1	13.1±1.1	0.8
RDW, median (min-max)	13.9 (12-16.7)	13.6 (11.9-23.7)	0.3
Platelet count, mean ±SD, $10^3/\mu L$	308±64.7	290±63.7	0.05
MPV, median (min-max), fL	7.0 (6-9.2)	7.6 (6.4-9.7)	**<0.001**
PDW, mean ±SD, fL	16.3±0.4	16.5±0.4	**0.005**
Platelet count/MPV, mean ±SD,	43.8±11.0	38.3±11	**0.001**
Platelet count/PDW, mean ±SD,	18.8±3.8	17.5±3.9	**0.024**

WBC: White blood cell, RDW: Red cell distribution width, MPV: Mean platelet volume, PDW: Platelet distribution width

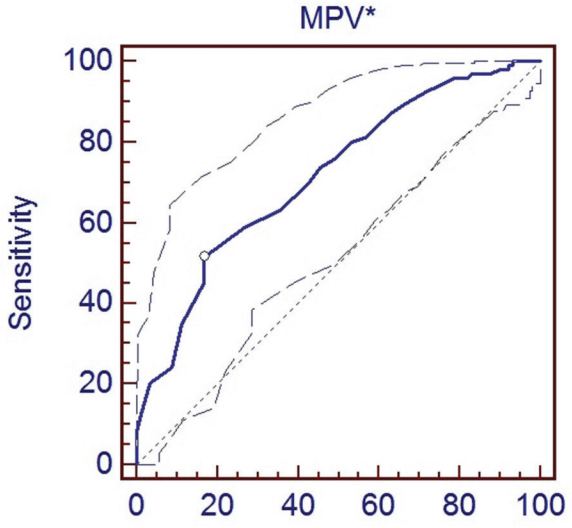

Figure1. ROC curve, indicating AUC (area under the curve) for allergic rhinitis

Discussion

When children with allergic rhinitis were compared with healthy children in our study, a decrease was found in mean platelet volume (MPV) and PDW. In addition, when the cut off value of MPV was taken as smaller than 7 fl, specificity for allergic rhinitis was found to be 83%.

Studies conducted so far have shown that platelets have a role in chronic inflammation. Activated thrombocyte has been shown to play an important role in diseases such as atherothrombosis, atherosclerosis, rheumatoid arthritis, ulcerative colitis and asthma [9-12]. In chronic allergic inflammation formed with animal models, thrombocytes activated in bronchial hyperresponsiveness, bronchoconstriction, airway inflammation, and airway remodeling play a significant role in the migration of eosinophils and lymphocytes [3,4,13-15]. While there are no studies showing platelet activation in patients with allergic rhinitis so far according to our knowledge, we think that platelets have a role in allergic inflammation of patients with allergic rhinitis similar to patients with allergic asthma. Clinical studies have shown a more complex picture of the platelet in asthma. On the one hand, platelets from patients with asthma are characterized by an increased activation and an increased release of growth factors such as brain-derived neurotrophic factor (BDNF) [16-20]. On the other hand, platelets from patients with asthma have been postulated to be less responsive to various stimulants such as collagen, adenosine diphosphate (ADP) [21] platelet-activating factor (PAF) [22], and arachidonic acid [23] suggesting that platelets might be 'exhausted' as a consequence of chronic activation [14]. Stoll et al made the following comment in the editorial comment; "It might be speculated that 'exhausted' platelets are smaller in size due to chronic activation and chronic mediator release in asthmatic patients". The fact that the inflammation in patients with allergic rhinitis is similar to the inflammation in the bronchi of patients with allergic asthma and the high level of platelet-derived endothelial cell growth factor expression in the nasal mucosa of patients with allergic rhinitis in a study conducted by Mori et al [2] can be considered as the low MPV value being an indicator of platelet activation. In contrast to our study, one study demonstrated that MPV value can be increase in the atopic disease such as asthma [17].

As well as being influenced by obesity, smoke exposure and diseases coursing with chronic inflammation, the difference in platelet volume can differ from person to person due to pleomorphism. Genome-wide association studies have estimated that the phenotypic variance caused by the cumulative effects of more than 60 known polymorphisms lead to MPV differences of up to 9.9% [24]. Therefore, MPV size was taken smaller than 7 fl as cut off value, specificity for allergic rhinitis was determined as 83% and sensitivity as 51.6 % in our study. This result may be interrogation for low sensitivity value which may not exactly point out platelet activation in the allergic rhinitis. In addition, it was found no relation between the severity of allergic rhinitis and MPV size in the current study

There were a few limitations in our study. One of these was the fact that we did not measure the plasma platelet factor-4 and Beta thromboglobulin level which show platelet activation. The second one was the fact that MPV values of patients with allergic rhinitis were not checked again after the treatment. Since the allergic inflammation in nasal mucosa will decrease after treatment, we will be able to see the change in MPV more clearly.

Conclusions

In conclusion, MPV levels decrease in children with allergic rhinitis and this shows indirectly that platelets are activated. Especially in patients with allergic rhinitis, the specificity of MPV values smaller than 7 fl is high.

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