

## **MPV and PDW as inflammatory indicators in chronic otitis media with effusion.**

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### **Abstract**

**Objectives:** Chronic Otitis Media with Effusion (COME) is a clinical condition characterized by an effusion in the tympanic cavity. In this retrospective study, we aimed to compare the MPV and PDW value of patients with chronic otitis media with effusion (COMA) to those in healthy subjects as an inflammatory indicator.

**Materials and methods:** Demographic features: age, race and gender and laboratory parameters; White Blood Cell count (WBC), Red Blood Cell count (RBC), Hemoglobin (Hb), Hematocrit (Hct), Platelets (PLT), MPV and PDW were recorded after obtaining from the computerized database.

**Results:** We included 149 patients who underwent ventilation tube insertion between with those of age and sex compatible 151 healthy subjects into the study. In our study no statistically significant differences were identified between paediatric patients diagnosed with COME and healthy controls in terms of WBC, RBC, Hb, Hct, and MPV levels ( $p>0.05$ ). However, we found significant differences both the platelet count ( $p<0.05$ ) and PDW levels ( $p<0.001$ ) between the COME and control group.

**Conclusion:** This study is the first to evaluate the relationship between PDW and COME. With regards to clinical and laboratory findings, novel inflammatory markers derived from routine hemogram test may be used.

**Keywords:** Mean platelet volume, Platelet activation, Otitis media with effusion, Inflammation.

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### **Introduction**

Otitis media with effusion is a middle ear inflammatory disease. A variety of potent inflammatory mediators has been detected in middle ear effusions of children with OME [1].

Chronic Otitis Media with Effusion (COME) is a clinical condition characterized by an effusion in the tympanic cavity lasting longer than 3 months without an acute infection. Otitis media with effusion, a term synonymous with chronic non-supportive otitis media, secretory otitis media, serous otitis media, and glue ear, is one of the most common chronic ontological conditions of childhood period. Thus, this condition can lead to the impairment of children's development of linguistic, behavioural, motor, and social skills [2-4].

If left untreated, it causes atelectatic tympanic membrane, adhesive middle ear disease, and cholesteatoma development, which may lead to a permanent hearing loss. Platelets have a critical role in homeostasis and tissue repair [5-7]. Moreover, recently it has been discovered that platelets also have a role in the inflammatory process. Platelet cytoplasmic granules contain several inflammatory products, including the Platelet Activation Factor (PAF), Platelet-Derived Growth Factor (PDGF), Platelet Factor-4 (PF4), beta-Thromboglobulin (b-Tg), Interleukin-1 (IL-1), leukotrienes, and prostaglandins [8,9]. Increased platelet activation plays an important role in

the development of inflammation and it was found that platelets significantly contribute to chronic inflammation, and MPV may be used as a marker of inflammatory disease [10-12].

Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) are routine hematologic parameters used to measure and understand platelet activity. Young platelets with large volume have intense granules in their cytoplasm; enzymatically and metabolically they are much more active [13]. Since increased platelet activation has an important role in the inflammatory process, it can be used as an indicator of inflammation [10-12,14,15]. PDW shows differences in the size of platelets in circulation; an increase in the PDW level indicates that there are more different sizes of platelets in circulation, while a decrease in PDW indicates that there are more similar sized, old platelets in circulation [16].

In the present study, we have investigated the role of MPV and PDW as an inflammatory indicator in 149 paediatric patients with COME.

### **Materials and Methods**

The MPV and PDW parameters were collected retrospectively from the files of 149 paediatric patients who underwent ventilation tube insertion operation for COME between

December 2009 and December 2015. Patients with chronic inflammatory diseases, active infection, diabetes mellitus and malignancy were excluded. Subjects on treatment with an agent that may influence CBC parameters, such as aspirin or steroid, were also excluded. Control subjects were selected from healthy volunteers who visited outpatient clinics of our hospital for a routine check-up.

The blood samples were collected in sterile tubes containing a fixed amount of anticoagulant and analyzed in several minutes with ABX Micros automatic hematologic analyzer (ABX Micros: HORIBA, California, USA). Patient files were analyzed from the archives of the hospital computer automation program. Demographic features, namely age, race and gender; and laboratory parameters, i.e. White Blood Cell count (WBC), Red Blood Cell count (RBC), Hemoglobin (Hb), Hematocrit (Hct), Platelets (PLT), MPV, and PDW, were obtained and compared with those of the control group. Approval for the study was granted by the Hospital Ethics Committee. Data were analyzed using SPSS for Windows. Variables of qualitative data were expressed as numbers and percentages, while variables of quantitative data were expressed as means or min-max ranges. To compare the groups for the categorized variables, Mann-Whitney U test was used for the quantitative variables. A p-value less than 0.05 are considered as statistically significant.

## Results

Adenoidectomies and/or tonsillectomies were performed in 149 paediatric cases diagnosed with serous otitis media. We only performed adenoidectomy for which no inflammation was found in the histopathological examination in 149 cases which were included in the study. These parameters were analyzed statistically by comparing them with the MPV and PDW levels of the control group, which included randomly selected, 151 healthy children. The mean age of the study group was  $6.75 \pm 2.67$  y (the minimum age was 2 and the maximum age was 16 y); the mean age of the control group was  $6.69 \pm 3.66$  y (the minimum age was 2 and the maximum age was 16 y). The study group included 65 (43.6%) female and 84 (56.4%) male patients; the control group included 68 (45.0%) female and 83 (55.0%) male subjects. The mean MPV levels of the study and control groups were  $7.53 \pm 0.98$  and  $7.64 \pm 0.9$ , respectively; there was no significant difference between the groups ( $p=0.195$ ). The mean PDW levels of the study and control groups were  $13.35 \pm 1.85$  and  $14.14 \pm 2.26$ , respectively, and the difference between the two groups was significant ( $p<0.05$ ) (Figure 1). The mean platelet count of the study group was  $330.65 \pm 90.91$ ; the mean platelet count of the control group was  $307.64 \pm 76.18$ . This difference was also significant ( $p=0.026$ ) (Table 1).

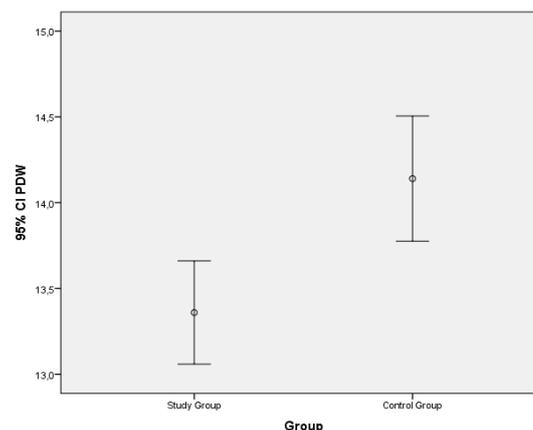
**Table 1.** The parameters of sex, age, and hematologic findings in the COME and control groups.

	Study group (n=149)	Control group (n=151)	P value <sup>a</sup>
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Age (y)	$6.75 \pm 2.67$	$6.69 \pm 3.66$	0.601
Sex, F/M, n (%)	65 (43.6%)/84 (56.4%)	68 (45.0%)/83 (55.0%)	0.806
WBC ( $\mu\text{L}$ )	$8.34 \pm 2.56$	$8.03 \pm 2.9$	0.108
RBC ( $106/\mu\text{L}$ )	$4.65 \pm 0.4$	$4.66 \pm 0.38$	0.843
Hb (g/dL)	$11.67 \pm 1.11$	$11.89 \pm 1.04$	0.069
Hct (%)	$36.23 \pm 3.13$	$36.76 \pm 3.12$	0.162
PLT ( $\text{K}/\text{m}^3$ )	$330.65 \pm 90.91$	$307.64 \pm 76.18$	0.026
MPV (fL)	$7.53 \pm 0.98$	$7.64 \pm 0.9$	0.195
PDW	$13.35 \pm 1.85$	$14.14 \pm 2.26$	0.001

F: Female; M: Male; WBC: White Blood Cell count; RBC: Red Blood Cell count; Hb: Hemoglobin; Hct: Hematocrit; PLT: Platelets; MPV: Mean Platelet Volume; PDW: Platelet Distribution Width;  $\pm$ : Standard deviation. <sup>a</sup>Statistical analysis was performed with the Mann-Whitney U-test.

The study and control groups were tested according to the significance of the parameters. PDW ( $p=0.001$ ) showed variability, while MPV ( $p=0.195$ ) did not show any variability in the comparison of the study and control group (Figure 1).



**Figure 1.** PDW averages in the COME and control group.

## Discussion

In this study, we have evaluated COME and its association with MPV and PDW in paediatric patients. The main finding of this study was inflammatory markers derived from routine CBC tests useful for differentiation of patients with COME from healthy subjects. COME is an inflammatory disease of the middle ear. Eustachian tube dysfunction, adenoid hypertrophy, viral and bacterial infections, and allergies are important etiologic factors.

The inflammatory cells that infiltrate the middle ear mucosa secrete pro-inflammatory products like PAF, prostaglandins, leukotrienes, histamine, TNF- $\alpha$ , interleukin-1 $\beta$ , and interleukin 8 [17-20]. These inflammatory cytokines have been determined in both animal and human clinical studies [18,21,22]. Recently, it has been reported that platelets have a role in diseases characterized by systemic inflammation, and increased MPV may be used as a marker of inflammation [23-25]. In studies made with patients who have an inflammatory disease, such as

rheumatoid arthritis, psoriasis, ankylosing spondylitis, and nasal polyposis, increased MPV values have been observed [24,26,27]. Sagit et al. reported that the MPV levels of nasal polyposis patients were significantly higher than those in the healthy control group [27,28]. Apuhan et al. described that decreased MPV in nasal polyposis was a statistically significant difference between study and control groups [29]. Thus, there are discrepancies in recent studies regarding levels of MPV in terms of inflammation and infection. Somuk et al. reported no statistically significant differences were identified between paediatric patients diagnosed with COME and healthy controls in terms of MPV levels [30]. Platelet distribution width is an indicator of platelet size heterogeneity. A high PDW value suggests a large range of platelet sizes due to swelling, destruction, immaturity, and high reactivity. In the recent studies of Ozturk et al. PDW has been found to be associated with several clinical situations [31]. In the literature review, high PDW levels were found in coronary artery disease, benign paroxysmal positional vertigo, pulmonary embolism, acute gangrenous appendicitis, obstructive sleep apnoea syndrome, preeclampsia, and preterm labor, in patients with nasal polyposis [32,33]. Ozturk et al. studied 175 patients with inflammatory bowel disease and found that there was a statistically significant decrease in PDW levels during disease exacerbation compared to healthy control subjects [31]. Ulu et al., in their study of 40 idiopathic sudden sensorineural hearing loss cases, reported that both the MPV and PDW levels were significantly higher in the study group compared to the control group [34]. In a study of 160 acute gangrenous appendicitis patients, it was reported that PDW was a much more accurate diagnostic test than MPV [35].

In our study, the platelet count was higher in the study group ( $p < 0.05$ ). The PDW level was lower in our study group than in the control group ( $p < 0.001$ ). We think that middle ear disease with effusion is a localized inflammation and it has no impulse effect on bone marrow to produce young and active platelets.

Although our study has a limitation due to retrospective character, it has shown that the increase in PDW levels was an inflammatory sign in COME. In the case of high PDW level in adenoidectomy operation, care should be taken for inflammation. So, MPV and PDW data might be useful as an additional inflammatory marker of COME. Thus, prospective and controlled studies are needed to confirm PDW level as an additional marker in COME patients.

### Conflict of Interest

No conflict of interest was declared by the authors.

### Financial Disclosure

The authors declare that this study received no financial support.

### Ethics Committee

This information was obtained retrospectively from the archives of the hospital's computer automation program. The study was conducted with data from human beings.

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