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ORIGINAL ARTICLE

The Role of Blood Inflammatory Parameters in the Evaluation of Otitis Media with Effusion in Children with Obstructive Adenoid Hypertrophy: A Retrospective Study

Obstrüktif Adenoid Hipertrofili Çocuklarda Kan İnflamatuar Parametrelerinin Efüzyonlu Otitis Media Değerlendirilmesindeki Yeri: Retrospektif Bir Çalışma

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ABSTRACT

Aim: It has been reported that inflammatory parameters of neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR), eosinophil-basophil ratio (EBR), systemic immune-inflammatory index (SII), and mean platelet volume (MPV) in the blood have prognostic and diagnostic values in diseases accompanied by inflammation. Serous/Mucoid differentiation of otitis media with effusion (OME) and the decision to apply a ventilation tube (VT) can be difficult. Our study aimed to examine the importance of blood inflammatory parameters in the evaluation of effusion character in OME with obstructive adenoid hypertrophy (OAH).
Methods: Preoperative blood tests of 215 pediatric patients operated on with the diagnosis of OAH in our clinic between January 1st and December 31st, 2022 were scanned. Patients with OME were grouped as Serous OME (Group 1, n=33) and Mucoid OME (Group 2, n=69). Children without accompanying OME were considered the control group (Group 3, n=113). NLR, PLR, EBR, SII, and MPV values of the groups were compared.
Results: NLR value was found to be significantly lower in Group 1 than in Group 3 (p=0.023). MPV values were found to be significantly lower in Group 2 compared to Group 3 (p=0.015). No significant difference was detected between the groups in terms of other parameters.
Conclusion: The low NLR may suggest that the effusion may be the serous character. In patients with low MPV, it should be taken into account that mucoid EOM increases.

Keywords: Adenoidectomy, lymphocyte, neutrophil, obstructive adenoid hypertrophy, otitis media with effusion, thrombocyte

ÖZ

Amaç: Enflamasyonun eşlik ettiği hastalıklarda kanda nötrofil lenfosit oranı (NLO), trombosit lenfosit oranı (TLO), eozinofil bazofil oranı (EBO), sistemik immun-inflamatuar indeks (SII) ve ortalama trombosit hacmi (MPV) enflamatuar parametrelerinin prognostik ve tanısal değeri olduğu bildirilmiştir. Efüzyonlu Otitis Media'da (EOM), efüzyonun seröz/müköz ayrımı ve Ventilasyon Tüpü (VT) uygulama kararı zor olabilir. Çalışmamızda, Obstrüktif Adenoid Hipertrofi (OAH) sebebi ile opere olan çocuklarda, kan inflamatuar parametrelerinin EOM varlığında efüzyon karakterini belirlemedeki yerini değerlendirmek amaçlanmıştır.
Yöntem: 1 Ocak-31 Aralık 2022 arasında kliniğimizde OAH tanısı ile opere edilen 215 çocuk hastanın preoperatif kan tetkikleri tarandı. EOM olan hastalar, Seröz EOM (Grup 1, n:33) ve Müköz EOM (Grup 2, n:69) olarak gruplandı. EOM eşlik etmeyen çocuklar kontrol grubu (Grup 3, n:113) olarak değerlendirildi. Grupların NLO, TLO, EBO, SII ve MPV değerleri karşılaştırıldı.
Bulgular: NLO değeri, Grup 1'de Grup 3'e göre anlamlı derecede düşük bulundu (p=0,023). MPV değeri, Grup 2'de Grup 3'e göre anlamlı derecede düşük bulundu (p=0,015). Diğer parametreler açısından gruplar arasında anlamlı fark saptanmadı.
Sonuç: OAH ve EOM olan çocuklarda NLO'nun düşük olması efüzyonun seröz karakterde olabileceğini düşündürebilir. MPV'nin düşük olduğu hastalarda müköz EOM'nın arttığı gözönünde bulundurulmalıdır.

Anahtar Kelimeler: Adenoidektomi, efüzyonlu otitis media, lenfosit, nötrofil, obstrüktif adenoid hipertrofi, trombosit

Introduction

Otitis media with effusion (OME) is the accumulation of fluid in the middle ear without acute signs of infection. It is important to diagnose it early because it may cause speech delay, a decrease in school performance, and behavioral problems in children older than 2 years of age due to hearing loss (1). Eustachian tube dysfunction, adenoid, and allergic diseases are often blamed for etiology (2). Studies conducted in recent years argue that inflammatory markers in the blood have prognostic and diagnostic value in diseases accompanied by inflammation (3,4). Results showing a relationship between effusion character and these parameters in OME have been reported (5-7). However, in previous studies, the etiological factor was not specified in OME patients. Obstructive adenoid hypertrophy (OAH) alone may cause differences in inflammatory parameters, independent of OME (8). Comparing the differences in inflammatory parameters

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in children with OME, regardless of the OAH factor, may be more informative. For this purpose, we have planned a study in which all groups will consist of children undergoing surgery for OAH with or without OME. The objective of this study is to assess the role of blood inflammatory parameters in predicting the type of effusion in OME.

Materials And Methods

In this retrospective study, preoperative blood tests and surgery notes of children operated on for OAH by 3 otorhinolaryngology physicians in our clinic between January 1st and December 31st, 2022 were scanned. The term OAH was used for adenoid hypertrophy causing 60% or more obstruction compared to the choanae during flexible nasopharynx examination. Patients not having a preoperative blood test and whose intraoperative effusion characteristics were not specified were excluded from the study.

In patients with OME undergoing ventilation tube (VT), the effusion character was recorded as serous or mucoid in the operating notes. Children without OME were considered as the control group (Group 3, n:113). Patients with OME were grouped as serous OME (Group 1, n=33) and mucous OME (Group 2, n=69). Neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR), eosinophil-basophil ratio (EBR), systemic immune-inflammatory index (SII), and mean platelet volume (MPV) inflammatory parameters obtained from the preoperative blood tests of the patients were compared statistically.

Statistical analysis

Values in the table are given as mean ± standard deviation (SD). The Windows-based Statistical Package for Social Sciences, version 24.0 program (SPSS, IBM Inc., Armonk, NY, USA) was used for appropriate statistical analyses. In the two-group analysis, the student t-test was used to compare normally distributed variables, and Mann Whitney U test was used to compare non-normally distributed variables. P <0.05 was considered as the significance threshold. This study was approved by the ethics committee (Bursa City Training and Research Hospital, Clinical Research Ethical Committee, 2023-5/2, 05.04.2023) and was conducted under the 1961 Declaration of Helsinki Principles and its later amendments.

Results

Two hundred and fifteen children (103 girls and 112 boys) undergoing surgery due to OAH were included in the study. Among children with OME, 33 children with serous effusion were evaluated as Group 1, and 69 children with mucoid effusion were evaluated as Group 2. One hundred and thirteen children with no OME formed the control group (Group 3). The average age of groups was 5.7, 5.9, and 5.3 years, respectively (p=0.406), and the proportion of males was 54.5, 50.7, and 52.2%, respectively (p=0.936). The distribution of blood inflammatory parameters by groups is given in the table (Table 1).

Table 1. The distribution of blood inflammatory parameters by groups

Variables	Group 1 (n=33)	Group 2 (n=69)	Group 3 (n=113)
Age (years)	5.70±2.14	5.96±1.98	5.38±2.44
Neutrophil (10^3/uL)	3.96±2.02	4.43±2.14	4.20±1.76
Lymphocyte (10^3/uL)	4.48±1.86	3.95±1.30	3.71±1.28
Platelets (10^3/uL)	366.9±124.78	364.25±87.42	348.91±87.36
MPV (fL)	9.40±0.95	9.21±0.81	9.51±0.78
NLR	0.97±0.53	1.23±0.73	1.36±1.57
PLR	89.39±29.32	99.22±34.57	103.02±39.75

MPV: Mean platelet volume, n: Number of patients, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio,

In Group 1, the neutrophil count (3.96 103/uL) was low and the lymphocyte count (4.48 103/uL) was high compared to the other groups. NLR was found to be significantly lower in Group 1 compared to the control group (mean 0.97 and 1.36, respectively; p = 0.023). There was no significant difference in NLR between Group 2 and the control group (mean 1.23 and 1.36, respectively; p = 0.793).

The MPV value was found to be significantly lower in Group 2 compared to the control group (mean 9.21 and 9.51, respectively; p = 0.015). There was no significant difference between Group 1 and the control group in terms of MPV (mean 9.40 and 9.51, respectively; p = 0.345).

No significant difference was detected between the groups in terms of PLR, SII, and EBR values. A comparison of inflammatory parameters between groups (Mann-Whitney U test) is given in Table 2. Mucous OME was observed to increase in spring and winter compared to other months (p = 0.04). The distribution of the groups according to seasons is given in Table 3.

Table 2. Comparison of inflammatory parameters between groups by the Mann-Whitney U test

Group Number	NLR	PLR	SII	EBR	**MPV**
1-3	p: 0.023	p: 0.160	p: 0.083	p: 0.574	p: 0.345
1-2	p: 0.067	p: 0.369	p: 0.087	p: 0.895	p: 0.440
2-3	p: 0.793	p: 0.532	p: 0.789	p: 0.247	p: 0.015

EBR: Eosinophil-basophil ratio, MPV: Mean platelet volume, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, SII: Systemic immune index

Table 3. The distribution of the groups by seasons

Operation time	Group 1 (n=33)	Group 2 (n=69)	Group3 (n=113)	Total (n=215)
Spring	27.3%	31.9%	15%	22.3%
Summer	18.2%	20.3%	31%	25.6%
Autumn	24.2%	17.4%	31%	25.6%
Winter	30.3%	30.4%	23%	26.5%

n: Number of patients

Discussion

OME is a common condition observed in children aged 1 to 3 and by the age of 4, the cumulative incidence of OME reaches 80% (9). Experimental studies have shown that when a ventilation disorder develops in the middle ear, there is an increase in partial CO2 pressure, leading to vacuum and membrane retraction in the middle ear cavity. In cases where sufficient ventilation cannot be achieved, the middle ear cavity starts to accumulate serous fluid during the acute inflammation period due to the influence of the vacuum. It has been demonstrated that chronic inflammation leads to metaplasia in the middle ear mucosa, an increase in goblet cells, increased vascular permeability, and the occurrence of mucoid effusion through inflammatory mediators (9-12).

Adenoidectomy and VT insertion, in children with OAH and OME, can significantly reduce the recurrence rate of otitis and shorten the drainage time of middle ear effusion and provide better hearing outcomes (13). Rasheed et al. suggested that VT insertion in conjunction with adenoidectomy is statistically superior to adenoidectomy with myringotomy alone in the treatment of OME (13). However, some studies recommended only myringotomy with adenoidectomy as the first choice of surgical treatment to avoid complications of VT insertion (14). In a study conducted by Zhang et al. on 312 children with OME, they performed just myringotomy for serous fluid in the tympanic cavity and VT insertion for jelly fluid in the tympanic cavity. They found no statistically significant difference between the outcomes of the groups and concluded that the treatment of OME should not only be combined with the disease course but also with different hearing loss and the characteristics of effusion in the tympanic cavity (15).

Surgical intervention and VT insertion are generally recommended to eliminate mucous effusion (16). Knowing the effusion character in OME can help the surgeon in planning medical treatment, follow-up period, or early surgical intervention (6). However, assessing viscosity without paracentesis is difficult. It has been reported that hearing loss is detected more frequently in mucous OME, but the level of hearing loss may not be determined in age groups where hearing test evaluation is not possible (5). USG application through the external auditory canal was attempted to define the effusion character as thin or thick. However, it was reported that the waveforms could not be interpreted on the computer in 34% of the cases, and therefore reliable results could not be obtained (17). Currently, no predictor can be used to determine the viscosity of middle ear effusion.

It has been reported that there may be changes in neutrophils, lymphocytes, platelets, and MPV in the blood in inflammatory diseases, depending on the severity of inflammation. NLR may help evaluate the etiology and prognosis of these diseases (5, 18-20). Neutrophils are responsible for persistent inflammation, while lymphocytes play a role in the regulatory immune pathway. NLR provides information about both inflammatory and immune pathways (21). Platelets, when stimulated due to inflammation, release pro-inflammatory substances and their numbers increase. High NLR and PLR values have been associated with the severity of inflammation (21, 22). SII is a newly defined inflammatory index, calculated as "platelet count multiplied by neutrophil count divided by lymphocyte count," which has been suggested as a prognostic marker for malignancy and inflammatory conditions (23).

In previous studies, it has been reported that lymphocyte counts were lower and NLR and PLR values were significantly higher in serous OME compared to healthy children (5-7). In our study, we found that children with serous OME undergoing surgery for OAH had higher lymphocyte counts and significantly lower NLR values (<1) compared to children without otitis. No difference was observed in PLR values among

the three groups. These differing results suggest that inflammatory parameters may vary depending on the causative factor in OME. Previous studies have compared children with OME, where the causative factor was unspecified, to completely healthy children. In our study, all three groups consisted of children undergoing surgery with a diagnosis of OAH. Therefore, our findings may be more useful in differentiating between serous or mucous OME, which can occur simultaneously, especially in children with OAH. Generally, a high NLR is associated with poor prognosis and severe inflammation (23). The low NLR value in serous OME may be due to the lower severity of inflammation and the dominance of the regulatory pathway in inflammation. One study reported that a low MPV value in OME favored mucoid effusion (5). In our results, we found that MPV was significantly lower in children with mucous OME undergoing surgery for OAH compared to children with OAH where otitis was not detected. Another study reported that a high SII (>510) was associated with an inflammatory state and poor prognosis in patients with sensorineural hearing loss (23). No studies were found regarding the evaluation of SII in OME. In our patients, no significant difference was found in terms of SII among the three groups.

In our study,it was observed that mucous OME increased in the spring and winter months compared to other months. In a previous study by Tian et al, it was reported that the incidence of OME in the winter and spring months was higher than in the summer and autumn months, and this situation was found to be consistent with the seasonal change of meteorological environmental factors and was related to air quality, air pressure and temperature (24). They reported that the average daily OME patient number increased as air quality worsened, air pressure increased and temperature decreased (24). Nevertheless, we think that an increase in allergic and viral rhinitis during the spring and winter months may contribute to a higher prevalence of mucoid effusions in these seasons.

The limitations of our study are that it was a single-centered retrospective study and effusion character was evaluated subjectively. We think that multi-center and prospective clinical studies are necessary in this area.

Conclusion

In children with OAH and OME, NLR and MPV values may help clinicians distinguish between serous or mucous effusion based on clinical findings. A low NLR may suggest that the effusion is serous in pattern. The presence of a low MPV should raise the possibility of mucous effusion in patients.

Author Contribution

All authors contributed to the concept, design, data collection, literature review, and analysis of the study. The corresponding author was responsible for writing the article.

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