CLINICAL STUDY

THE ROLE OF SERUM IRON LEVELS IN CHRONIC OTITIS MEDIA WITH EFFUSION

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SUMMARY

Objective: Otitis media with effusion (OME) is an important cause of hearing loss, especially in children at preschool period. In this study, our aim is to investigate whether there is a relationship between serum iron levels and the formation of chronic OME.

Materials and Methods: In this study, the files of the patients with OME and the control group were reviewed retrospectively. Hemogram parameters, ferritin, iron and iron binding capacities of both OME and control groups were recorded and the two groups were compared in terms of these parameters.

Results: A total of 105 children were included in this study, of which 54 were in the OME group and 51 were in the control group. There was no significant difference between the two groups in terms of gender and age ($p>0.05$). There was no significant difference between the two groups in terms of mean hemoglobin (Hb) value, mean iron binding capacity and median iron, mean erythrocyte volume (MCV), mean corpuscular hemoglobin concentration (MCHC), red blood cell (RBC) and red cell distribution width (RDW) values ($p>0.05$). Median ferritin and hematocrit values of the OME group were significantly lower than the control group ($p<0.05$).

Conclusion: In this study, the ferritin levels of the OME group were significantly lower than the control group. Neverthless, there is a need for larger studies that examine the relationship between the frequency of OME and serum iron levels in children.

Keywords: Iron, otitis media with effusion, child

EFÜZYONLU KRONİK OTİTİS MEDİADA SERUM DEMİR DÜZEYLERİNİN ROLÜ

ÖZET

Amaç: Efüzyonlu otitis media (EOM), özellikle okul öncesi dönemdeki çocuklarda önemli bir işitme kaybı nedenidir. Bu çalışmada bizim amacımız, serum demir seviyeleri ile kronik EOM oluşumu arasında bir ilişki olup olmadığını araştırmaktır.

Gereç ve Yöntemler: Bu çalışmada EOM hastalarının ve kontrol grubunun dosyaları retrospektif olarak tarandı. Hem EOM hem de kontrol grubunun hemogram parametreleri, ferritin, demir ve demir bağlama kapasiteleri kayıt altına alındı ve iki grup bu belirtilen parametreler açısından karşılaştırıldı.

Bulgular: Bu çalışmaya 54 kronik efüzyonlu otitis media hastası çocuk ve 51'i kontrol grubu olmak üzere toplam 105 çocuk dahil edildi. İki grup arasında cinsiyet ve yaş açısından anlamlı bir fark yoktu ($p>0.05$). Ortalama hemoglobin (Hb) değeri, ortalama demir bağlama kapasitesi ve medyan demir, ortalama eritrosit hacmi (MCV), ortalama korpüsküler hemoglobin konsantrasyonu (MCHC), kırmızı kan hücresi (RBC) ve kırmızı hücre dağılım genişliği (RDW) değerleri açısından iki grup arasında anlamlı fark yoktu. ($p>0.05$). EOM grubunun medyan ferritin ve hematokrit değerleri kontrol grubuna göre anlamlı derecede düşüktü ($p<0.05$).

Sonuç: Bu çalışmada efüzyonlu otitis media grubunun ferritin düzeyleri kontrol grubuna göre istatistiksel olarak anlamlı oranda daha düşüktü. Çocuklarda efüzyonlu otitis media sıklığı ile serum demir seviyeleri arasındaki ilişkiyi inceleyen daha geniş katılımlı çalışmalara ihtiyaç olduğunu düşünmekteyiz.

Anahtar Sözcükler: Demir, efüzyonlu otitis media, çocuk

INTRODUCTION

Otitis media with effusion (OME) is fluid accumulation in the middle ear without signs of infection.[1] Prevalence reaches its peak at around 2 and 5 years of age.[2] Many cases heal on their own, while in some others the effusion may remain for more than 3 months. These cases with chronic effusion are termed as chronic OME.[3] The prevalence of chronic OME in Turkey has been reported as 8.7%, which is quite high.[4]

OME is important cause of hearing loss, especially in children in preschool period.[5] Hearing loss that begins in early childhood can affect a child's speech and therefore social interactions.[6] Therefore, chronic OME should be followed carefully and closely.

Although there is no consensus on the treatment of OME, the child with OME, who is not at risk, should be managed carefully for 3

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months from the date of diagnosis. In addition, topical or systemic steroids, antibiotics, antihistamines and decongestants are not routinely recommended in current guideline.[7]

Iron deficiency is more common in underdeveloped countries and usually affects children and women.[8] Iron has a critical role in the normal functioning of a cell.[9] Iron metabolism is critical for the normal cognitive and motor development of children and is also necessary for the immune system.[10,11] Many studies reveal that impaired iron metabolism is associated with chronic inflammatory processes.[12] In childhood, anatomical differences and inflammatory processes caused by mucosal edema in the eustachian tube are asserted as important risk factors for OME.[7] In this study, our aim is to investigate whether there is a relationship between serum iron levels and the formation of chronic OME.

MATERIAL and METHODS

Children who were diagnosed with OME in our clinic and whose OME were resisted in their 3-months of follow-up between December 2020 and December 2021 were included in this study. Children who did not have any disease and applied to the pediatric outpatient clinic for control in the same period and did not have any upper respiratory tract infection in the last period, were also included as the control group.

Patient files were scanned retrospectively from the hospital system. Children who had received antibiotic prophylaxis due to chronic infection, had craniofacial anomalies, had immunodeficiency, had previous ventilation tube application or who underwent adenotonsilectomy surgery, and who had adhesive otitis were excluded from the study.

Patients' demographic data, medical history (gastroesophageal reflux (GERD), allergic diseases), environmental factors (day nursery, school, passive smoking status, etc.) and familial factors (number of siblings) were also evaluated. In the otoscopic examination, retraction of the eardrum, loss or displacement of the light triangle, discoloration of the eardrum, and air bubbles were also interpreted in favor of OME. Type B and C tympanograms were interpreted in favor of OME.

Hemoglobin (Hb), mean erythrocyte volume (MCV), Hematocrit (Htc), red blood cell (RBC), ferritin, red cell distribution width (RDW), iron, mean corpuscular hemoglobin concentration (MCHC) and iron binding capacity of both the OME and control group were determined. Permission was obtained for this study from the local committee of Necmettin Erbakan University with decision numbered 3948 at 2022. Our study was carried out considering the conditions of the Declaration of Helsinki.

Statistical Analysis :

Shapiro-Wilk and Kolmogorov-Smirnov tests were performed to reveal whether the data were normally distributed. Not-normally distributed data were specified as median (interquartile range) while normally distributed data were specified as mean ± standard deviation. Mann-Whitney U or Student's t-test was used to compare the data between the two groups. The chi-square test was preferred for comparing the categorical variables. If the p value was less than 0.05, the result was considered statistically significant.

RESULTS

There was a total of 105 children, of which 54 were in the OME group and 51 were in the control group. The median age of both groups was 6 years. There were 33 male and 21 female in the OME group, while 31 male and 20 female in the control group. There was no significant difference between the two groups in terms of gender and age ($p>0.05$). There was no significant difference between the OME and control groups in terms of comorbidity and GERD ($p>0,05$). The history of family smoking, the child's going to daycare, the history of recurrent upper respiratory tract infection and allergy were significantly higher in the OME group ($p<0.05$). While the median value of the number of siblings was 2 in the OME group, it was 0 in the control group and this was statistically significant ($p=0.001$)(Table 1).

No significant difference was found in terms of mean Hb value, mean iron binding capacity and median iron, MCV, MCHC, RBC and RDV values between the two groups ($p>0.05$). Median ferritin and htc values of the OME group were significantly lower than the control group ($p<0.05$) (Table 2).

Table 1. Distribution of demographic datas belonging to groups

Parameters	**OME Group n=54 median (IR)**	**Control Group n=51 median (IR)**	**P value**
Gender Male/Female n(%)	33 (61,1)/21(38,9)	30 (58,8)/21 (41,2)	0,811
Age (years)	6(3)	6(5)	0,624
Number of siblings(n)	2(1)	0(2)	**0,001**
Additional illness No/Yes	47(87.0)/7(13.0)	47 (92,2)/ 4(7,8)	0,392
Smoking in the family No/Yes	14 (25,9)/40(74,1)	27 (52,9)/24 (47,1)	**0,005**
Status of nursery No/Yes	17(31,5)/37(68,5)	27 (52,9)/ 24(47,1)	**0,026**
Recurrent Infection (Upper airway) No/Yes	19(35,2)/35 (64,8)	37 (72,5)/14 (27,5)	**0,001**
GERD No/Yes	48(88,9)/6(11,1)	50(98)/1(2)	0,113
Allergy history No/Yes	29(53,7)/25(46,3)	48(94,19/3(5,9)	**0,001**

Abbreviations : IR : Interquartile Range

Tablo 2 . Distribution of hemogram and iron parameters according to groups

Parameters	OME Group n=54 (IR)	Control Group n=51 (IR)	P value
Hb (g/dL)	12,6 ±0,9	13,0±0,9	0,073
Ferritin (µg/dL)	27,7 (28,61)	36,0 (31)	**0,026**
Iron (µg/dL)	65,0 (40)	79,0 (58)	0,097
Iron Binding Capacity (µg/dL)	276,42±57	258,86±62	0,137
Htc (%)	38,0 ±2,62	39,1±2,86	**0,043**
MCV (fL)	80,3 (5,45)	80,9 (5,60)	0,145
MCHC (g/dl)	33,3 (1,13)	33,4 (1,40)	0,509
RBC (x10^6/µl)	4,77 (0,56)	4,86 (0,45)	0,348
RDW (fL)	38,0 (3,08)	38,1 (2,70)	0,421

Abbreviations : Hb: Hemoglobin, MCV : mean erythrocyte volume, Htc : Hematocrit, MCHC : mean corpuscular hemoglobin concentration, RBC : red blood cell, RDW : red cell distribution width , IR : Interquartile Range

DISCUSSION

OME is an inflammatory condition that can lead to hearing loss in children, and it can cause deterioration in social development with reduced school performance.[13] Personal and environmental factors and socioeconomic status are common risk factors in OME.[14] In our study, the rate of smoking in the family and going to kindergarten was found to be significantly high in the OME group, while the rate of GERD were found to be similar in both groups.

Iron deficiency is common world wide. Iron deficiency is an important threat especially in the pediatric age group.[15,16] In a recent study in our country, the rate of iron deficiency was found to be 26.2 %, and the rate of iron deficiency anemia to be 13.1 % in 1-17 aged healthy children.[16]

Iron deficiency is the stage before iron deficiency anemia and anemia occurs if iron replacement is not done. Regardless of the cause, many biochemical reactions, cellular functions, mental and academic functions, physical capacity, temperature regulation, gastrointestinal and cardiovascular system efficiency, growth and development, and immune system in the body are damaged in the presence of anemia.

Iron is vital in many critical cellular functions such as DNA synthesis and repair and enzymatic activity.[9]

There is some evidence that iron deficiency anemia may increase susceptibility to infections in the pediatric population. This situation may be associated with decreased neutrophil and macrophage function, decreased production of proinflammatory cytokines, and increased risk of extracellular infection.[10,17] Therefore, iron deficiency may play a role in the formation of OME by affecting the proinflammatory process or causing frequent upper respiratory tract infections.

In a study examining the relationship between chronic suppurative otitis media and iron deficiency anemia in children, the authors reported that iron deficiency anemia may increase the incidence of chronic suppurative otitis media.[18] The first study examining the relationship between iron deficiency and OME was made by Akcan et al.[12] In this prospective controlled study, iron metabolism was compared between children who underwent surgery for chronic OME and children who underwent surgery for another reason, and it was observed that iron deficiency anemia was significantly higher in patients with chronic OME. The authors stated that iron deficiency anemia may be a risk factor for the development of OME and iron parameters should be evaluated in these children. Our study differs from this study in two aspects. In the uppermentioned study Akcan et al., the control group consisted of patients who were operated for inguinal hernia, while the control group in our study consisted of healthy participants. In addition, patients were also included in this study when they had acute infections such as upper respiratory tract infection and acute otitis media. We excluded patients with active infection because acute infection may affect serum iron levels. A recent review reported that infection can cause significant changes in the host's iron metabolism, including the redistribution of iron within tissues.[19]

Taki et al.[20] reported a 49-year-old patient with iron deficiency anemia and low-frequency sensorineural hearing loss resistant to steroid therapy, the mean thresholds of patient at pure tone audiometry returned to the normal range with systemic iron therapy. In our study, while ferritin and Htc values were significantly lower in the OME group, no significant difference was found between the two groups in terms of mean Hb value, mean iron binding capacity and median iron, MCV, MCHC, RBC and RDV values. In addition, serum ferritin levels were within normal limits in both groups.

The main limitation of the study is its retrospective nature. For this reason, our study groups were not homogeneously distributed in some respects. When the groups were examined in terms of risk factors, it was seen that the conditions that contributed to the development of OME, such as the number of siblings, allergies and the history of going to a nursery were significantly higher in the OME group. Therefore, there is a need for prospective studies in which such risk factors are homogenized for more high level of evidence.

CONCLUSION

Iron deficiency is a common worldwide problem which plays a crucial role in general well-being and public health. In this study, the levels of ferritin in the OME group were found to be significantly lower. Accordingly it can be asserted that iron deficiency and increased inflammatory status may lead to the development of OME. Additionally, we think that there is a need for prospective studies examining the relationship between the frequency of OME and iron deficiency anemia in children.

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