

PLATELET COUNT INCREASES IN CHRONIC OTITIS MEDIA PATIENTS WITH BLOCKED EUSTACHIAN TUBE

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Abstract:

Objectives: The aim of the present study was to examine the levels of complete blood count (CBC) parameters (Neutrophil, lymphocyte, platelets, MPV, NLR, and PLR) in patients with both perforated eardrums and dysfunctional eustachian tubes to determine which of these parameters might be reliable biomarkers of chronic otitis media prior to surgery, as inflammation is significant component of middle ear pathology.

Materials and methods: In this study, we enrolled 95 patients with 18-65 years old. Patients with chronic otitis media (perforated tympanic membranes) more than three months in duration who have no draining ears, were enrolled in Okmeydanı Training & Research Hospital. Patients were divided into three groups: Group 1 is "Open eustachian tube" group in which pressure changes (if evident) during swallowing were recorded on stepladder-type graphs; Group 2 is "Blocked" group, who could not neutralize the negative pressure even by repeated swallowing. Group 3 is "Partially blocked" group in whom some residual pressure persisted even after five swallows. The groups were compared in terms of laboratory tests.

Results: There was a statistically significant difference between 3 groups in terms of platelet levels ($p>0.05$). We found that group 2 / blocked eustachian tube had significantly increased platelet counts values when compared to the group 1 and 3. There was no significant difference among group 1 and group 3. There was no statistically significant difference between the 3 groups in terms of neutrophil, lymphocyte count, MPV, NLR, PLR levels, bone and air hearing thresholds.

Conclusion: We found that the platelet count increased in chronic otitis media patients with blocked eustachian tube. This may be a simple and inexpensive biomarker with acoustic impedencemeter tests supporting eustachian dysfunction before tympanoplasties.

Key Words: Hematological biomarkers; eustachian tube dysfunction; chronic otitis media

1. Introduction

The eustachian tube has important role in the pathogenesis of otitis media as middle ear is ventilated by the tube. Drainage of middle ear fluids and protection from nasopharyngeal secretions are the other functions and if it does not work properly, this may cause chronic otitis media (1). The success

rate of tympanoplasty is affected by tube functionality, being higher when tube function is normal and vice versa (2-5). Tube function can be evaluated using both static and dynamic tests (5-11). Instillations of dye, saccharine or radioactive substances via middle ear are the examples of static tests. Dynamic tests include sonotubometric,

manometric, videoendoscopic and acoustic impedance tests. Acoustic impedance audiometer can be easily used to study the physiological behavior of the tube. Eustachian tube blockage causes chronic middle ear edema and inflammation with/without granulation tissue (1, 7, 11). Thus, chronic inflammation is part of this blockage. Recent studies have found that, the neutrophil to lymphocyte ratio (NLR), the mean platelet volume (MPV) and the platelet to lymphocyte ratio (PLR) are of diagnostic and predictive utility in systemic inflammatory disorders, cancer, cardiovascular diseases which may be used as diagnostic and prognostic indicators (12-28). These ratios have also been investigated as biomarkers of sudden idiopathic sensoryneural hearing loss and nasal polyposis (18-20).

The aim of the present study was to examine the levels of complete blood count (CBC) parameters (Neutrophil, lymphocyte, platelets, MPV, NLR, and PLR) in patients with both perforated eardrums and dysfunctional eustachian tubes to determine which of these parameters might be reliable biomarkers of chronic otitis media prior to surgery, as inflammation is significant component of middle ear pathology.

2. Methods and Materials

In this clinical trial, we enrolled 95 patients with 18-65 years old. Patients with chronic otitis media (perforated tympanic membranes) more than three months in duration who have no draining ears, were enrolled in Department of Otolaryngology, Okmeydani Training & Research Hospital (Istanbul, Turkey) from February through December of 2015. This study was approved by Ministry of Health Okmeydani Training and Research Hospital's local Ethics Committee on 14.4.2015 with number 290. Informed consent was obtained by all patients.

After clinical examination, all patients diagnosed with inactive chronic otitis media underwent automated Toynbee Testing by Audiometrists of the Audiovestibular Unit (1, 29). An Impedance Audiometer (Interacustics-AT 235 H-Tympanometry, Denmark) was used for this test. A pressure of +300 H₂O was applied and residual pressure was measured after 4 or 5 swallows over about 40 seconds.

Patients were divided into three groups: Group 1 is "Open eustachian tube" group in which pressure changes (if evident) during swallowing were recorded on stepladder-type graphs; Group 2 is "Blocked" group, who could not neutralize the negative pressure even by repeated swallowing. Group 3 is

"Partially blocked" group in whom some residual pressure persisted even after five swallows (21). Thus, eustachian tube function was defined tympanometrically.

Patients with cleft palates, allergic rhinitis, laryngopharyngeal reflux, chronic sinusitis, upper respiratory tract infections, who smoked, who had hypertension, diabetes or any chronic disorders, who were obese, who had metabolic syndrome, a history of previous middle ear surgery, or a nasopharyngeal mass, or who were pregnant, were excluded from the study.

Laboratory Measurements: Blood cell counts which is part of preoperative tests, were recorded for each patient before surgery (Sysmex XE-2100-2014, USA). These included neutrophil, lymphocyte and platelet counts. The NLR and PLR were calculated and included in patient charts.

Statistical methods: Data were expressed as mean (\pm SD). One-way analysis of variance (One way ANOVA) was used to compare normally distributed parameters among the three groups. Tukey's test was used to perform post-hoc comparisons among groups after One way ANOVA. The Kruskal Wallis test was utilized to compare the data that were not normally distributed. MannWhitney U test was used to perform post-hoc comparisons among groups after Kruskal Wallis test. A p-value was considered at <0.05. All analyses were performed using MedCalc Statistical Software version 12.7.7 (MedCalc Software Bvba-Ostend/Belgium, 2014)

3. Results

The numbers of patients (n:95) in the three groups were: Group 1/Open: n:64 (67.4%), Group 2/Blocked: n:17 (18.9%) and Group 3/Partially blocked: n:14 (13,7%). The Female/Male ratio was 56/39. Patient population had a mean age of 34.6 years. There was no statistical difference according to the sex ($p > 0,05$).

The test results of the study groups are shown in Table 1. No statistically significant difference among the groups was evident in terms of neutrophil or lymphocyte count (Kruskal Wallis, One way ANOVA; $p=0.291$ & 0.066 , respectively); **however, the platelet count differed significantly ($p<0.05$), (one-way ANOVA, $p=0.019$). We found that group 2 / blocked eustachian tube had significantly increased platelet counts values when compared to the group 1 and 3 (Tukey's test, $p <0.05$).** There was no significant difference among group 1 and group 3. No significant differences among groups (Kruskal-Wallis test) were

evident in terms of the MPV ($p=0.100$), NLR thresholds ($p=0.388$, $p=0.173$) (Table 1). ($p=0.243$), PLR ($p=0.893$) or the bone or air hearing

Table 1: The comparison of laboratory parameters between three groups

	Group 1 (Open) n: 64 Mean (\pm SD)	Group 2 (Blocked) n: 17 Mean (\pm SD)	Group 3 (Partially Blocked) n: 14 Mean (\pm SD)	p
Neutrophil ($10^3/\mu\text{L}$)	4,0 (\pm 1,6)	4,0 (\pm 1,6)	5,0 (\pm 2,2)	0,291
Lymphocyte ($10^3/\mu\text{L}$)	2,2(\pm 0,6)	2,6(\pm 0,6)	2,3(\pm 0,4)	0,066
Platelets ($10^3/\mu\text{L}$)	242(\pm 57,3)	285,1(\pm 58,2)	252,5(\pm 47,4)	0,019
MPV (fL)	10,65(\pm 0,7)	10,27 (\pm 0,6)	10,79(\pm 1)	0,100
NLR	1,9(\pm 1,1)	1,6(\pm 0,6)	2,0(\pm 0,9)	0,243
PLR	117,9(\pm 41,7)	116,4(\pm 34,9)	111,9 (\pm 25,1)	0,893
Hearing Threshold (Bone)	11,6(\pm 8,5)	16,1(\pm 13,0)	14,9(\pm 11,9)	0,388
Hearing Threshold (Air)	37,3 (\pm 13,6)	44,4(\pm 16,4)	38,3(\pm 14,5)	0,173

4. Discussion

Pre-operative tympanometric analysis prior to tympanoplasty are important as eustachian tube provides middle ear aeration, drainage and protection function (1, 5). A healthy eustachian tube is a prerequisite for tympanic cavity after middle ear surgery. In the present study, we explored the function of eustachian tube for chronic otitis media patients who have not intact tympanic membrane using impedance audiometer-automatic Toynbee test. Eustachian tube blockage is thought to be caused by tube edema per se and/or chronic middle ear edema and inflammation with/without granulation tissue (1, 7, 11, 20).

Poe et al (8) used videoendoscopy to show that the tubes of the ears with active pathologic conditions (otitis media with effusion, tympanic membrane retraction, pathologic draining, and cholesteatoma) exhibited significant abnormalities. The etiologies of these conditions included inflammation, infection,

allergy, reflux, primary muscular disorders and anatomical blockage. Aquino et al (30) described pathological torus tubarius changes in patients with retracted tympanic membranes; the most common pathologies of the tubal ostium were lymphoid hyperplasia and inflammation in patients with chronic otitis media patients.

Neutrophil and platelet numbers increase during an inflammatory response. These cells play important roles in acute or chronic inflammation by releasing proinflammatory mediators. The roles played by neutrophils in chronic disease, tissue injury, and repair have just begun to understood, although their role in acute inflammation is well-known. Accumulations of neutrophils within tissues are observed in patients with chronic conditions including chronic obstructive pulmonary disease, rheumatoid arthritis, and cardiovascular diseases. Chemokines, lipid mediators, fragments of complement, and several other materials trigger neutrophil migration into tissues (13). Platelets interact with both

leukocytes and endothelial cells, secrete chemokins and generate inflammatory lipids (12, 13). The NLR and PLR serve as inflammatory biomarkers in diseases including Behcet's syndrome, Rheumatoid arthritis, sudden hearing loss, nasal polyposis, cardiovascular diseases and malignancy in all of which systemic inflammation is an important feature (14-23). The MPV may be a new marker of inflammation in Behcet's syndrome, asthma, chronic obstructive pulmonary disease, arthritis (20, 24, 25). Biljak et al (26) found that both MPV and platelet count were biomarkers of inflammation. Jensvoll et al (27) also showed that platelet count may be a marker of thromboembolism.

We sought differences between eustachian tube dysfunction (blocked or partially blocked) groups and open group in terms of these inflammatory hematologic biomarkers. We found no significant differences in neutrophil and lymphocyte count among the groups. No significant difference among the groups was evident in terms of the MPV, NLR, PLR, bone or air hearing threshold. The absence of significant differences in neutrophil and lymphocyte counts among the groups may be explained by the fact that the tubes were largely obstructed with granulation tissue and chronic inflammation. Also, neutrophil levels may remain normal in the absence of acute exacerbation.

We found that group 2 / blocked eustachian tube had significantly increased platelet counts values when compared to the group 1 / open eustachian tube and 3 / partially blocked eustachian tube. There were no significant differences among group 1 and group 3.

Platelets are mainly involved in thrombosis and hemostasis. However, studies have shown that platelets play a major role in infection and inflammation (31). Chemokines released from activated platelet membranes have been shown to play important roles in immune response. These chemokines have been shown to be involved in the initial response to the immune response, such as acute phase reactants, as neutrophils, granulocytes, monocytes, and even have direct antimicrobial effects (32, 33).

Based on the results of our study, increased platelet count can be used as a biomarker in chronic otitis media patients with blocked eustachian tube. We studied eustachian tube function in patients with chronic otitis media using Automatic impedance audiometer test termed Toynbee test. Therefore,

platelet count may be useful with Toynbee test. Even so, we believe that more comprehensive studies would be useful for clarifying the relationships between the eustachian tube function and platelets.

5. Conclusions

We found that the platelet count increased in chronic otitis media patients with blocked eustachian tube. This may be a simple and inexpensive biomarker with acoustic impedancemeter tests supporting eustachian dysfunction before tympanoplasties. Follow-up studies with larger sample sizes are required to confirm our findings.

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