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Analysis of Hematological Parameters in Patients with Sudden Sensorineural Hearing Loss

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ABSTRACT

Background: Sudden sensorineural hearing loss (SSHL) is an otologic emergency. Its etiopathogenesis is unknown. Platelet–lymphocyte ratio (PLR), neutrophil–lymphocyte ratio (NLR), and mean platelet volume (MPV) levels are high in peripheral vascular disease and in cases with systemic inflammation and have a weak association with prognosis. We aimed to determine whether NLR, PLR, and MPV levels are predictive values that can be used in the diagnosis of idiopathic SSHL.

Methods: Sixty patients with SSHL and 60 subjects with no additional diseases and no hearing loss were included into the study.

Results: The MPV for the study group was 7.77 ± 1.46. In the control group, this value was 10.07 ± 1.03 ($P = .001$; $P < .01$). NLR and PLR were compared as 3.48 ± 2.53 and 147.34 ± 94.33, respectively. In the control group, NLR and PLR were 1.99 ± 0.67 and 106.87 ± 30.13, respectively ($P = .001$, $P < .01$).

Conclusion: It was concluded that NLR and PLR could have a predictive value in SSHL, while MPV could not be used as a predictive value.

Keywords: Sudden sensorineural hearing loss, neutrophil, lymphocyte, platelet

Introduction

Sudden sensorineural hearing loss (SSHL) is an otologic emergency. The etiopathogenesis is not clearly known. It is defined as an SSHL of 30 dB or more occurring in 3 consecutive frequencies and developing over a period of 3 days or less.[1] The approximate incidence is reported to be 5-20/100 000 per year.[2] In terms of age groups, the incidence is higher in the 40-65 age group than in other age groups.[2] There are studies on the etiology, focusing on 4 different views: vascular causes (thrombus, vasospasm, embolism), autoimmune disease, viral infection of the cochlea, and cochlear membrane irregularities.[3]

Among these 4 theories, viral and vascular causes are particularly emphasized. However, in most patients, the etiological cause cannot be identified. Patients whose etiology cannot be identified are considered to have idiopathic SSHL.[4]

Platelet–lymphocyte ratio (PLR) and neutrophil–lymphocyte ratio (NLR) are derived from routine peripheral blood hemogram analysis. Elevated PLR levels have been observed in coronary artery disease, peripheral vascular disease, certain hepatobiliary malignancies, and certain gynecologic malignancies, although their prognostic value is limited. Neutrophil–lymphocyte ratio increases in the presence of systemic inflammation, certain gastrointestinal cancers, certain gynecological cancers, and some cardiovascular diseases.[5] Recent studies have suggested an increased NLR ratio in Bell's palsy and tinnitus, although the prognostic value is weak.[6] Mean platelet volume (MPV) serves as an easily assessable marker of platelet function and activation. Platelets play a central role in hemostasis, and elevated MPV may indicate endothelial damage.[7] In the literature, there are few studies investigating NLR, PLR, and MPV levels

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in SSHL patients with inconsistent results. Therefore, our study aims to determine whether PLR, NLR, and MPV levels have predictive value in the diagnosis of idiopathic SSHL.

Material and Methods

The study was approved by the Istanbul Medeniyet University ethics committee (date: 03.05.2017/280). In this retrospective study, the patients who came to the clinic between January 2015 and April 2017 with a diagnosis of SSHL were retrospectively reviewed. Since our study was retrospective, an informed consent form was not obtained. Complete blood count tests routinely obtained from patients admitted to our clinic were reviewed. Patients' medical histories were reviewed for head trauma, previous ear or intracranial surgery, the presence of chronic otitis media or other ear disease, and history of ototoxic drug use. Patients with previously known chronic otitis media, Ménière's disease, intracranial tumors, diabetes mellitus, and patients on steroid therapy were excluded from the study. Between the dates, 64 patients diagnosed with SSHL were retrospectively evaluated in our clinic. Based on the examination and history, 4 patients were excluded. Two of them had head trauma and the other 2 had intracranial mass, and the remaining 60 patients were diagnosed with idiopathic SSHL. Patients undergoing septoplasty surgery at our clinic and presenting with no ear-related complaints were selected for the control group, as routine blood samples had been taken for anaesthesia preparation. Consequently, no additional consent forms were taken from control group patients.Sixty subjects were included in the control group. Hematological parameters and demographic characteristics of the idiopathic SSHL patients were evaluated. Hematological analysis was performed using a Sysmex XE-2100 analyzer (Kobe, Japan). Hemoglobin, erythrocyte, neutrophil, leukocyte, lymphocyte, MPV, platelet count, and NLR and PLR values were calculated.

Statistical analysis was performed using Number Cruncher Statistical System 2007. Quantitative data were compared using Pearson's chi-square test, descriptive statistics (mean, standard deviation, median, frequency, ratio, minimum, maximum), and Student's *t*-test. Pearson correlation analysis was used to examine the relationship between age and measurement. Significance was assessed at $P < .01$ and $P < .05$ levels.

Results

The mean age of the 60 patients with idiopathic SSHL was 40.97 ± 15.79 years, and the male/female ratio was 22/38. At the time of diagnosis, 9 (15%) patients had mild, 16 (26.5%) patients had moderate, 22 (36.5%) patients had moderately severe, and 13 (22%) patients had severe hearing loss (Table 1). Tympanometric examination was routinely performed in each patient during audiological evaluation. None of the patients had any abnormal tympanometry findings. The mean age of the 60 subjects without idiopathic SSHL was 34.17 ± 12.09 years, and the male/female ratio was 17/43.

Table 1. Hearing Level Distribution and Tympanometry Results

Hearing Level	Number of Patients	Tympanometry	Percentage (%)
Mild	9	Type A	15
Moderate	16	Type A	26.5
Moderately severe	22	Type A	36.5
Severe	13	Type A	22

In the study group, leukocyte and neutrophil counts were 9.02 ± 4.0 and 6.25 ± 3.58, respectively. In the control group, leukocyte and neutrophil values were measured to be 7.81 ± 2.1 and 4.68 ± 1.68, respectively. There were statistically significant higher values in the study group compared to the controls as *P* values of .001, .039, and .003, respectively.

With regard to gender, the differences between the groups were not significant ($P > .05$).

In the study group, lymphocytes and platelets were measured to be 2.22 ± 1.11 and 252.95 ± 62.02, respectively. In the control group, lymphocyte and platelet values were measured to be 2.42 ± 0.62 and 244.97 ± 48.25, respectively. The differences between these 2 groups were not significant ($P > .05$).

The MPV value of the study group was found to be 7.77 ± 1.46. This value was measured to be 10.07 ± 1.03 in the control group. In the study group, MPV was lower than in the control group and it was significant ($P = .001$).

In the study group, NLR and PLR values were calculated to be 147.34 ± 94.33 and 3.48 ± 2.53, respectively. In the control group, NLR and PLR were calculated to be 1.99 ± 0.67 and 106.87 ± 30.13, respectively. Considering these values, it was statistically significant that the study group had higher values ($P = .001$, $P < .01$).

Table 2 details the demographics, hemogram parameters, and statistical comparisons of patients and controls.

Table 2. Comparison of Age–Sex and Hemogram Parameters in Patients with Idiopathic Sudden Sensorineural Hearing Loss

Parameters	Patient Group	Control Group	*P*
Age	47.77 ± 16.20	34.17 ± 12.09	.001**
Sex			
Female	22 (36.66%)	17 (29.3%)	
Male	38 (63.34%)	43 (71.7%)	.3
Hemoglobin	13.42 ± 1.84	14.68 ± 1.73	.001**
Leukocyte	9.02 ± 4.0	7.81 ± 2.1	.039*
Neutrophil	6.25 ± 3l.58	4.68 ± 1.68	.003**
Lymphocyte	2.22 ± 1.11	2.42 ± 0.62	.234
Platelet	252.95 ± 62.02	244.97 ± 48.25	.433
MPV	7.77 ± 1.46	10.07 ± 1.03	.001**
Neutrophil/lymphocyte	3.48 ± 2.53	1.99 ± 0.67	.001**
Platelet/lymphocyte	147.34 ± 94.33	106.87 ± 30.13	.002**
MPV/platelet	0.03 ± 0.01	0.04 ± 0.01	.001**

MPV, mean platelet volume.
*$P < .05$.
**$P < .01$.

MAIN POINTS

- *Values of some hematological parameters may change in sudden sensorineural hearing loss .*
- *Platelet–lymphocyte ratio and neutrophil–lymphocyte ratio (NLR) values may have a predictive value in sudden sensorineural hearing loss.*
- *It is still controversial whether mean platelet volume is a predictive value in sudden sensorineural hearing loss.*

Discussion

Although SSHL has been defined differently by different specialists, the generally accepted definition would be that it is, as Wilson states, an SNHL of 30 dB and above in 3 or more consecutive frequencies that develops in less than 3 days.[1-4]

In the literature, the incidence of SNHL has been reported in different proportions. The most important reason for this is the high rate of spontaneous recovery and the fact that not all patients with this condition present to health care facilities. Overall, the approximate incidence is reported to be 5-20/100 000 per year.[8,9]

As a result of the cumulative studies conducted on the literature published in Europe, Japan, and the USA, the mean age of incidence ranged between 43 and 53 years, and the ratio of females to males was reported to be equal, over 7500 patients. Shaia and Sheehy,[10] in their large series of 1220 cases, reported an equal gender distribution, which is consistent with the literature.[9-10] However, in our study, only 22 (36.6%) of 60 patients diagnosed with SSHL were female. It is believed that this finding, which is not consistent with the literature on gender distribution, is due to the small number of patients included in the study.

In this study we conducted, the mean age was found to be 40.9 years in the patients with SSHL. The age range varied from 18 to 45 years. The results we obtained were consistent with the literature data.[11] However, since the control group was selected as young healthy adults, there was a statistically significant difference with the mean age. It can be thought that the lower mean age of the control group may have affected the results. This is mentioned in the limitation section.

There are publications suggesting that leukocytes and specific lymphocyte subtypes may be inflammatory markers for cardiovascular disease. Neutrophil–lymphocyte ratio may be a potential new marker of inflammation and can be calculated from lymphocytes and neutrophils in peripheral blood samples.[12]

A strong relationship between stress and inflammation has been highlighted in the literature, with increases in white blood cell counts and inflammatory cytokines (tumor necrosis factor alpha (TNF-alpha), interleukin (IL)-6, IL-10, and IL-8) being associated with increases in stress.[13,14] Platelet–lymphocyte ratio and NLR have also been found to increase in conditions such as Bell's palsy, SSHL, vertigo, and tinnitus, as well as in inflammatory diseases.[5,13,15,16] The reason for this increase has been interpreted as an increase in stress-induced inflammation. Ni et al[17] in a review evaluated 18 studies in the literature and found that NLR and PLR values were higher in patients with SSHL than in the healthy group. In the current study, similar to the literature, NLR was significantly higher in idiopathic SSHL patients.

Platelets are known to play a critical role in the progression of atherosclerosis, and an elevated platelet count contributes to an increased PLR. As a result, it can lead to an escalation of vascular complications. Gary et al[18] reported a strong association between an elevated PLR and patients at increased risk of critical limb ischemia (CLI) and other cardiovascular complications. In particular, NLR and PLR can be used to differentiate CLI patients at higher risk of limb amputation within 5 years from those at lower risk within the same time period.[19] These ratios, calculated from readily available peripheral blood samples, provide a practical, cost-effective alternative to expensive inflammatory markers such as TNF-alpha, IL-1b, IL-6, and IL-8. In the study of 166 patients with SSHL performed by Karakurt et al,[20] PLR and NLR values were found to be significantly higher. Our study confirms these findings and shows a significant increase in PLR and NLR in the study group. This is in agreement with the existing literature.

Mean platelet volume is easily measured from peripheral blood. It has been reported to be associated with several diseases. High levels of MPV have been associated with endothelial damage and various cardiovascular diseases.[21] In a study of 40 patients, although the sample size was small, Ulu et al[22] reported higher MPV levels in patients with SSHL, suggesting a possible association. A similar study showed a positive correlation between SSHL and MPV, supporting the vascular pathology hypothesis.[23] In contrast to all these studies, in a meta-analysis, Ji et al[24] reviewed a total of 18 studies and found no significant relationship between MPV and SSHL.

When the results of our study were evaluated, hemoglobin values were found to be significantly higher in the control group. Since hemoglobin values were within normal limits in both groups, their relationship with SSHL was not evaluated. Another significant result was leukocyte levels. However, since leukocyte subgroups were evaluated in our study, the relationship between leukocyte values and SSHL was not examined.

The major limitation of our study was that there was a significant difference between age groups. However, the fact that all the hematological parameters of healthy people in the control group were normal may allow us to ignore the age difference.

Sudden Sensorineural Hearing Loss is a multifactorial disease with multifactorial etiology. In our study, PLR and NLR ratios were significantly higher in SSHL patients, which is consistent with the literature. Mean platelet volume was significantly lower in the study group. This finding contradicts some findings in the literature. These contradictions highlight the complexity of the relationship between MPV and SSHL and the need for further research to better understand this relationship. The results of the current study also suggest that NLR and PLR may have predictive value in SSHL.

Ethics Committee Approval: *Ethics committee approval was received for this study from the ethics committee at Istanbul Medeniyet University (date: 03.05.2017/0280).*

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