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Original article

Are neutrophil/lymphocyte and platelet/lymphocyte ratios related with formation of sudden hearing loss and its prognosis?

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ABSTRACT

Objectives: The aim of our study was to see whether the neutrophil/lymphocyte ratio (NLR) and the platelet/lymphocyte ratio (PLR) are the markers of idiopathic sudden hearing loss to be used in prognosis or not.
Materials and methods: This study is a retrospective, case-control clinical trial. Forty-five patients diagnosed with idiopathic sudden hearing loss and treated with the same treatment protocol between March 2014 and December 2015 and 47 healthy volunteers coming to the hospital for a routine health check and accepting audiological and laboratory tests were included in our study. NLR and PLR values were calculated in consequence of complete blood count results obtained from the study and control groups. In addition, the study group was classified as treatment responsive and treatment unresponsive groups as a result of audiological examination performed after three months according to the Siegel criteria. NLR and PLR ratios between the groups were statistically evaluated.
Results: Average NLR and PLR values were significantly higher in the study group compared to the control group ($P < 0.001$). Average NLR ratio of the group, which was treated with the same protocol but did not respond to treatment was found to be significantly higher compared to the group which responded to the treatment ($P < 0.001$). There was no significant change in average PLR ratio.
Conclusion: Although NLR and PLR are two important markers that can be detected from peripheral blood samples of patients developing idiopathic sudden hearing loss and can be calculated easily, increased NLR values were also found to be related to poor prognosis.
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1. Introduction

Sudden hearing loss (SHL) is an ear nose and throat (ENT) disease defined as 30 dB or more sensorineural type hearing loss at three consecutive frequencies within three days. SHL constitutes 1% of all sensorineural hearing loss (SNHL), and its incidence has been reported as 5–20/100,000 [1]. SHL is an ENT emergency, and early treatment is the most important factor in the response to treatment [1,2]. Although SHL is still defined as idiopathic, its etiology is thought to be multifactorial. In clinical studies, it is argued that viral infections, vascular insufficiency, and obstruction, inflammatory events, autoimmune and immunologic diseases are effective in SHL development [2]. Any of these factors could not be proved to be a decisive etiological factor [3,4]. Studies are showing the association of SHL with chronic inflammation [5]. Chronic inflammation can cause damage to the microvascular ischemia and atherogenesis, and this is a factor that increases the risk of ischemia directly [6]. Total white blood cell count (WBC), and its subtypes are used as classic inflammatory markers. Neutrophil/lymphocyte ratio (NLR) has been identified as a new inflammatory marker increasing in cardiac and non-cardiac conditions [7]. Neutrophils, which are activated by tissue destruction, release some enzymes such as myeloperoxidase, acid phosphatase, and elastase. During the inflammatory response, there are changes in circulating leukocytes' ratio. Relative lymphopenia accompanies Neutrophilia. Neutrophil/lymphocyte ratio (NLR) has been proposed as a simple marker of an inflammatory response [8]. Platelets lymphocyte ratio has been identified as a poor prognosis marker in peripheral arterial diseases such as atherosclerosis [9]. The aim of our study is to investigate whether NLR and PLR ratios are the markers of idiopathic sudden hearing loss to be used in prognosis or not.

2. Materials and methods

Forty-five patients diagnosed with SHL between March 2014 and December 2015 and 47 healthy volunteers coming to the

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hospital for health check were included in our study as a study and control group, respectively. SHL diagnosis was used for the patients with 30 dB or more sensorineural type hearing loss at three consecutive frequencies within three days. All patients underwent physical examinations, microscopic otologic examination, hematological and biochemical analysis, audiological evaluation and magnetic resonance imaging (MRI).

Our study was conducted as a retrospective case-control study with the approval of the local ethical committee of our hospital (Ethics Committee No. 2016-03-03).

Patients who have not used steroid therapy within seven days from the beginning of their complaints, underwent hematological and audiological examinations at the first visit and were diagnosed as having idiopathic SHL and were included in the study group.

Patients accepted to the polyclinic for health screening, not having any known chronic disease in their history, not having active signs of infection in the last 1 month, not taking any medication in the last 1 month, having no history of otologic and neurological disease and operations and being at the normal hearing threshold in audiological tests carried out (air-conduction hearing threshold 0–20 dB) were included in control group.

Patients with hearing loss due to retro-cochlear pathology, which was evidenced by acoustic brainstem response (BERA) or MRI, and patients considered with autoimmune inner ear disease or secondary infection SHL and bilateral SHL patients were excluded from the study.

Blood samples were obtained from patients during the initial application. NLR and PLR ratios were obtained by simply dividing the absolute neutrophil and absolute lymphocyte values. The Neutrophil, Lymphocyte and Platelet count was determined using the Pentra 120 Retic Hematology Analyzer (ABX, Montpellier, France), as part of the routine hemogram. The reference value for neutrophil, lymphocyte and platelet in our laboratory is 1.63–6.96 #; 1.09–2.99 #; 155–366 10e3/uL respectively.

Air and bone conductions were analyzed at 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz and 8 kHz frequencies. The audiological evaluation was made to all patients at first admission and in the controls three months after the end of therapy. Siegel criteria were used in assessing the response of the patients to treatment [10] (Table 1).

The study group was separated into two groups according to audiological evaluation results obtained three months after the end of treatment. According to Siegel criteria, type 1,2,3 groups were considered as the treatment responsive group and type 4 group was considered as the unresponsive group to the treatment. In the study group, 27 patients were grouped as treatment responsive patients and 18 patients were grouped as treatment unresponsive patients according to Siegel criteria.

During 14 days, systemic (oral) methylprednisolone (Prednol-L16 mg tb® and 4 mg tb®, Mustafa Nevzat, İstanbul, Turkey) with 1 mg/kg exact dose for 3 days and 8 mg decreasing dose for the following days, and concurrent intratympanic dexamethasone (Dekort® 2 ml/8 Mg, 1 ampoule, Deva, İstanbul, Turkey) were injected to all patients.

Table 1
Siegel criteria.

Type	Evaluation	Explanation
1	Complete recovery	Final hearing level[a] is 25 dB or better, regardless of the amount of gain
2	Partial recovery	More than 15 dB hearing gain and final hearing is between 25–45 dB
3	Poor recovery	More than 15 dB hearing gain and final hearing is 45 dB or worse
4	No recovery	Gain less than 15 dB

[a] Final hearing level: 500,1000,2000 and 4000 Hz arithmetic mean, Committee on Hearing and Equilibrium of the American Academy of Otolaryngology-Head and Neck Surgery.

In descriptive statistics of the data; mean, standard deviation, median minimum, maximum, frequency and ratio values were used. E-Distribution of variables was assessed by Kolmogorov-Smirnov test. Mann-Whitney U test and independent samples t-test were used in the analysis of quantitative data. Chi^2 test was used for the analysis of qualitative data. SPSS 22.0 (PASW for Windows®, Rel. 18.0.0. 2009; SPSS Inc., Chicago, IL, USA) program was used in the analyses.

3. Results

Mean age was 31.1 ± 7.4 years in the study group and 32.4 ± 8.1 years in control group. There were 20 females and 25 males in the study group while there were 28 females and 19 males in the control group. There were no significant differences between two groups regarding age and gender (Table 2).

Laboratory findings of patients and controls are given in Table 2. Average NLR value was 3.0 ± 2.2 in the study group and 1.7 ± 0.8 in the control group, and the difference was found to be statistically significant ($P < 0.001$) (Fig. 1, Table 2). Average PLR value was 137.3 ± 73.4 in the study group while it was found to be 95.8 ± 30.4 in the control group, and this difference was also statistically significant ($P = 0.02$) (Fig. 1, Table 2). Neutrophil values were higher, and lymphocyte values were lower in the study group compared to control group, but there was no significant difference in platelet values ($P = 0.012$, $P < 0.001$, $P = 0.982$; respectively) (Table 2).

Average NLR was 1.9 ± 0.5, average PLR was 115.7 ± 35.7 in the treatment responsive group while these ratios were 4.7 ± 2.6 and 169 ± 100.6, respectively, and NLR was found to be statistically significant while PLR was found to be insignificant ($P < 0.001$, $P = 0.110$; respectively) (Fig. 2, Table 3). Neutrophils, lymphocytes, and platelet counts were also evaluated between the groups. The neutrophil ratio was higher, and lymphocyte ratio was lower in

Table 2
Statistical data between the study and control groups.

	Case group		Control group		*P*
	Mean ± s.d./*n*, %	Med (min–max)	Mean ± s.d./*n*, %	Med (min–max)	
Age	31.1 ± 7.4	32.0 (16.0–47.0)	32.4 ± 8.1	34.0 (16.0–49.0)	0.360
Gender					
Female	20, 44.4%		28, 62.2%		0.146
Male	25, 55.6%		19, 42.2		
Neutrophils	5.6 ± 2.5	4.9 (1.8–13.2)	4.4 ± 1.4	4.3 (2.3–8.8)	0.012
Lymphocytes	2.1 ± 0.7	2.2 (0.7–3.6)	3.8 ± 6.6	2.7 (1.1–48.0)	0.000
Platelets	257 ± 61	265 (138–407)	257 ± 47	259 (128–363)	0.982
Neutrophils/lymphocytes	3.0 ± 2.2	2.4 (0.9–11.6)	1.7 ± 0.8	1.5 (0.0–4.2)	0.000
Platelets/lymphocytes	137.3 ± 73.4	117.6 (57.1–419.7)	95.8 ± 30.4	94.7 (4.2–185.1)	0.002

Mann-Whitney U test, *t*-test, Chi^2 test.

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