



The clinical and prognostic value of the neutrophil lymphocyte ratio, the platelet lymphocyte ratio and mean platelet volume in tinnitus patients

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Abstract

There are high number of studies about the relationship between inflammation and tinnitus. The aim of this study was to evaluate the prognostic importance of the use of the neutrophil-lymphocyte ratio (NLR), the platelet lymphocyte ratio (PLR), and the mean platelet volume (MPV) in patients with tinnitus. This prospective study included 74 patients and 65 healthy control group. The severity of the tinnitus was classified using the Tinnitus Handicap Index (THI). The neutrophil and lymphocyte counts, NLR, PLR and MPV values were recorded and compared between the groups. MPV, and MCV median values were determined statistically significantly higher in the patient group than in the control group ($p:0.001$, $p:0.000$). No statistically significant difference was determined between the groups in respect of the NLR and PLR ($p>0.05$). The mean THI score was calculated as 51.5 ± 21.1 (range, 12.0- 90.0). No statistically significant correlations were determined between the THI and NLR and PLR ($r:0.03$, $p:0.75$, and $r:0.04$, $p:0.70$). The MPV and MCV values were higher in tinnitus patients than in the control group. However, NLR and PLR were not determined to have any statistically significant relationship with tinnitus or the THI scores.

Keywords: mean platelet volume, neutrophil-lymphocyte ratio, platelet-lymphocyte ratio, tinnitus, tinnitus handicap index

1. Introduction

Tinnitus is the perception of sound when there is no acoustic stimulus in the environment. The sound perceived may be a pure tone or include more than one frequency. It can be pulsatile or fixed at a high or low pitch, in the form of a bell ringing, buzzing, murmuring, clicking, hissing, or a rough sound. As tinnitus is not a disease but a symptom, the ideal approach requires a comprehensive evaluation and the appropriate application of treatment tools and strategies (Jonas and Byron, 2013).

The incidence of tinnitus in the general population varies between 12% and 15%, and for 1-2% of patients, quality of life is severely affected (Kemal et al., 2016). The incidence is increasing in the 40-70 years age range, rising to 33% in patients aged >60 years. It is seen more frequently in males than females, but is rare in children (Jonas and Byron, 2013; Kemal et al., 2016).

Complete blood count (CBC) is an important and commonly used blood test in clinical practice. Several studies in recent years have used the neutrophil-lymphocyte ratio

(NLR), the platelet lymphocyte ratio (PLR), and the mean platelet volume (MPV), obtained from CBC values as markers in inflammatory processes. These rates are obtained from neutrophil and platelet values, which are markers of inflammation, and as a result of synthesis with lymphopenia which is a marker of psychogenic stress (Aydoğdu et al., 2017). Sudden sensorineural hearing loss, Bell's palsy, vestibular neuritis, squamous cell carcinoma of the head and neck, and tinnitus are some of the pathological conditions in ear, nose and throat (ENT) practice that have been determined to be related to NLR and PLR.

The mean platelet volume (MPV) is an inflammation marker showing the activation and function of platelets and can be easily determined from peripheral blood. A high MPV level is a sign that thrombocyte activity has increased causing more intense inflammation (Aydoğdu et al., 2017). An elevated MPV level has been found to be related with various pathological states including cardiovascular and cerebrovascular impairments and primarily deep vein thrombosis (Kemal et al., 2016).

It has been shown in literature that NLR, PLR and MPV as prognostic factors are high in patients with tinnitus and could be used as a marker (Ozbay et al., 2015; Sarıkaya et al., 2016; Kemal et al., 2016; Ulusoy et al., 2018; Kemal et al., 2019). The aim of this study was to evaluate the prognostic importance of NLR, PLR, and MPV values as clinical markers in patients presenting at our clinic with the complaint of tinnitus.

2. Materials and methods

A prospective examination was made of the findings of 74 patients between August 2016 and August 2018 with the complaint of tinnitus. The patients included were those who had the complaint of tinnitus for at least two weeks, with no systemic disease, no recent history of infection, and no findings of active ear infection.

All patients underwent a detailed ENT examination and audiometric tests to rule out any related pathological cause of the tinnitus. Those with moderate or severe hearing loss were excluded from the study because the hearing loss would have affected their ability to perceive tinnitus. Tinnitus patients with systemic diseases, malignancy or any inflammatory disease that could alter the neutrophil-to-lymphocyte ratio were also excluded from the study. Approval for the study was granted by the Local Ethics Committee of Ondokuz Mayıs University School of Medicine, Samsun, Turkey (Decision no: 2016/418). A control group was formed of the data of 65 age and gender-matched healthy individuals with no systemic disease and no recent history of infection, with data recorded in the clinic archives.

From the data obtained from the CBC of the patients; the MPV, neutrophil, lymphocyte, NLR, PLR and MCV values were determined. These values were compared with the data obtained from the control group. Evaluation was also made of whether there was any correlation between these values and the severity of tinnitus. To determine the subjective severity of tinnitus, the Tinnitus Handicap Index (THI), which is a standard scale, was used. The THI is a form comprising 25 items which evaluate the emotional, catastrophic and functional effects of tinnitus and measures the effects on the daily life of the patients (Table 1).

Responses are given as three alternatives of “Yes, No and Sometimes”. Scoring is applied as Yes = 4 points, sometimes = 2, and No =0, and thus the total points can range from 0 to 100 (Newman et al., 1996; Meikle et al, 2012). The THI was applied to all the patients in the study to determine the subjective severity of tinnitus and the correlations between THI and the NLR, and PLR were evaluated.

2.1. Statistical analysis

All data were analyzed statistically using SPSS version 15 software (SPSS Inc., Chicago, IL, USA). Continuous variables were stated as mean ± standard deviation (SD), minimum and maximum values, and frequency data as number (n) and percentage (%). Conformity of the data to normal distribution

was assessed with the Kolmogorov-Smirnov test. Data obtained from the counts were evaluated with the Chi-square test and continuous variables not showing normal distribution, with the Mann Whitney U-test. Relationships between the THI, NLR and PLR were evaluated with the Spearman Correlation test. A value of p<0.05 was accepted as statistically significant.

Table 1. Tinnitus handicap inventory (beta version)

Questions	Points		
	4	0	2
Because of your tinnitus is it difficult for you to concentrate?	Y	N	S
Does the loudness of your tinnitus meke it difficult for you to hear people?	Y	N	S
Does your tinnitus make you angry?	Y	N	S
Does your tinnitus make you confused?	Y	N	S
Because of your tinnitus are you desperate?	Y	N	S
Dou you complain a great deal about your tinnitus?	Y	N	S
Because of your tinnitus do you have trouble falling asleep at night?	Y	N	S
Do you feel as though you cannot escape from your tinnitus?	Y	N	S
Does your tinnitus interfere with your ability to enjoy social activites (Such as going out to dinner, to the cinema)?	Y	N	S
Because of your tinnitus do you feel frustrated?	Y	N	S
Because of your tinnitus do you feel that you have a terrible disease?	Y	N	S
Does your tinnitus make it difficult to enjoy life?	Y	N	S
Does your tinnitus interfere with your job or household responsabilites?	Y	N	S
Because of your tinnitus do you find that you are often irritable?	Y	N	S
Because of your tinnitus is it difficult for you to read?	Y	N	S
Does your tinnitus make you upset?	Y	N	S
Do you feel that your tinnitus has placed stress on your relationships with members of your family and friends?	Y	N	S
Do you find it difficult to focus your attention away from your tinnitus and on to other things?	Y	N	S
Do you feel that you have no control over your tinnitus?	Y	N	S
Because of your tinnitus do you often feel tired?	Y	N	S
Because of your tinnitus do you often feel depressed?	Y	N	S
Does your tinnitus make you feel anxious?	Y	N	S
Do you feel you can no longer cope with your tinnitus?	Y	N	S
Does your tinnitus get worse when you are under stress?	Y	N	S
Does your tinnitus make you insecure?	Y	N	S
Total Score Per Column			
Y, Yes; N, No; S, Sometimes			

3. Results

The statistical evaluations of the gender distribution and the NLR, PLR, MPV and MCV values of the patient and control groups are shown in Table 2.

The patient group had 62.1% males and 37.9% females with a mean age of 52.4±13.4 years where the control group had 52.3% males and 47.7% females with a mean age of 50.6±14.8 years. No statistically significant difference was determined between the groups in respect of age or gender ($p>0.05$, $p>0.05$).

The MPV and MCV median values were determined to be statistically significantly higher in the patient group than in the control group ($p:0.001$, $p:0.000$). NLR and PLR parameters were not statistically significant between two groups ($p>0.05$). In the evaluations applied, no significant difference was determined between the groups in respect of the other variables (Table 2).

Table 2. Demographic data and laboratory test results of the tinnitus group and the control group

	Tinnitus Group mean±sd (min- max)	Control Group mean±sd (min-max)	p
Female/male	28/46	30/33	0.326
Haemoglobin (g/dl)	13.8±1.4 (10.0-16.4)	13.7±1.8 (8.3-18.5)	0.974
MCV	87.0±5.5 (71.8-101.1)	83.7±5.8 (60.8-96.4)	0.001
Red cell distribution width (µm)	13.6±1.9 (11.8-24.3)	13.3±1.5 (11.6-20.3)	0.457
Mean platelet volume (µm ³)	10.3±0.8 (8.7-13.1)	8.3±0.8 (6.4-10.9)	0.000
NLR	2.2±1.1 (0.9-7.3)	2.2±1.1 (0.6-6.3)	0.501
PLR	118.8±45.8 (5.9-332.2)	130.9±76.6 (60.-583.0)	0.489

The THI score of the whole patient group was determined as mean 51.5±21.1 (range, 12.0-90.0), as mean 58.6±24.2 (range, 14.0-88.0) for females and mean 47.2±18.0 (range, 12.0-90.0) for males, with no statistically significant difference determined between the genders ($p:0.08$). Correlations between the THI and NLR and PLR were evaluated, and no statistically significant correlations were determined ($r:0.03$, $p:0.75$ and $r:0.04$, $p:0.70$, respectively).

3. Discussion

Tinnitus, which is frequently encountered in ENT practice, can be defined as the perception of sound without any sound stimulus (Eğilmez et al., 2014).

The sound perceived by the patient in objective tinnitus originates in any region of the body and forms as a result of turbulent blood flow in particular and of muscle contractions in the head and neck region. The sound perceived by the patient in subjective tinnitus is formed without any known sound source and is only heard by the patient. While a cause may be determined as a physical examination finding or radiologically in objective tinnitus, if no cause can be shown, it can be referred to as subjective tinnitus (Eğilmez et al., 2014).

Although various studies have been conducted on the

etiology of tinnitus, the etiology has not been fully clarified. It may originate from impairments in the outer, middle or inner ear or in the auditory nerve. Tinnitus has been reported to be related to several potential factors such as audiological, neurological, cardiovascular, metabolic, infectious, drug-related, dental, psychological and physiological impairments (Jonas and Byron, 2013; Kemal et al., 2016).

Neutrophils and lymphocytes are known to be responsible for inflammation. MPV is another marker reflecting thrombocyte activity and has been shown to be related to inflammation and the severity of inflammation. Neutrophil, platelet and monocyte concentrations increase in the inflammatory response and lymphocyte concentrations in the peripheral blood flow decrease (Zahorec, 2001; Aydoğdu et al., 2017).

NLR and PLR can be easily calculated from the peripheral blood and are new biomarkers of subclinical inflammation. This has become an increasingly widely used, inexpensive, easy and practical method used in the diagnosis and prognosis of various diseases, as these are just as valuable as the inflammatory markers of IL-6, IL-1 β , IL-8 and TNF- α , which have high costs (Seo et al., 2014; Aydoğdu et al., 2017).

In recent years, NLR and PLR have been used as prognostic markers in atherosclerosis and have been reported to be useful in the determination of peripheral artery obstructive diseases. NLR and PLR have been shown to be increased in systemic inflammation, in some gynaecological and gastrointestinal cancers, brain tumours and some cardiovascular diseases. It has also been shown that NLR could be useful in the determination of short and long-term mortality in acute coronary syndrome (Aydoğdu et al., 2017; Yersal et al., 2018).

In the current study, it was aimed to determine whether or not there was any relationship between tinnitus and NLR, PLR and MPV. In studies by Kemal et al. (2016) and Sarikaya et al. (2016) which examined the relationship between tinnitus and MPV, it was reported that the MPV value was statistically significantly higher in tinnitus patients than in a control group. Özbay et al. (2015) conducted a study to determine the relationship between NLR and inflammation in patients with severe tinnitus. The mean NLR was found to be significantly higher in patients than in the control group and it was concluded that NLR should be considered as a potential marker when evaluating tinnitus patients.

Ulusoy et al. (2018) examined the NLR, PLR and MPV values in tinnitus patients and found a significant difference between the patient and control groups in respect of the MPV value, but no significant difference was determined in respect of the other parameters.

In another study by Bayram et al. (2015) which examined the relationship between tinnitus and NLR, PLR and MPV, no significant relationships were determined and the authors concluded that NLR, PLR and MPV may not be useful

parameters in the routine clinical evaluation of tinnitus patients. Bucak et al. (2014) compared neutrophil count and NLR in Bell's palsy patients and a control group and reported that both neutrophils and the NLR were statistically significantly higher in the patient group than in the control group. In a study of patients with sudden hearing loss, Aydoğdu et al. (2017) examined the mean NLR and PLR and found that both ratios were statistically significantly higher in the hearing loss patients compared to the control group. In addition, as the NLR and PLR levels were higher in patients who recovered compared to those who did not recover, these ratios were evaluated as a poor prognostic factor.

The NLR was also found to be statistically significantly higher in sudden hearing loss patients compared to a control group in a study by Ulu et al. (2013) In the same study, the response to treatment was seen to be lower in patients with high NLR, and thus it was reported as a poor prognostic factor. In contrast, Karli et al. (2013) and Blaha et al. (2015) examined the relationship between MPV and the extent of sudden hearing loss and found no statistically significant correlation. In our study, MPV and MCV values were statistically significant in patients with tinnitus compared to control patients, but there was no significant difference between the two groups in terms of NLR and PLO. According to these findings, MPV and MCV may be used as a cheap prognostic criterion in tinnitus. But a prognostic cut off value should be determined.

In conclusion, the data obtained in this study were found to be consistent with previous findings in literature, in that MPV and MCV values were determined to be higher in patients with tinnitus. These findings support the view that inflammation has a role in the etiology of tinnitus. However, the other parameters examined of NLR and PLR, were not determined to have any statistically significant relationship with tinnitus or the THI scores.

Conflict of interest

None to declare.

Acknowledgments

None to declare.

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