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Neutrophil-to-lymphocyte ratio in patients with peripheral vertigo: A prospective controlled clinical study

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ABSTRACT

We aimed to investigate the relationship between peripheral vertigo and inflammation by using the neutrophil-to-lymphocyte ratio (NLR) as an inflammatory marker. We recruited 103 patients with peripheral vertigo (71 women, 32 men; mean age, 39.8 ± 14.7 years) who presented to the Otolaryngology Department of Dumlupinar University Hospital. Vertigo patients with systemic diseases, neurological disorders, malignancy or any inflammatory disease that could alter the NLR were excluded from the study. We also enrolled 103 age- and sex-matched healthy subjects (controls; 82 women, 21 men; mean age, 36.7 ± 13.5 years) who underwent routine checkups in our hospital. The vertigo patients underwent full otolaryngologic and neurologic examinations and audiometric tests to rule out any other pathology causing the peripheral vertigo. NLR was calculated in all subjects and was compared between the patient and control groups. There were no significant differences between the study and control groups in terms of lipid profiles, liver-function tests, white blood cell (WBC) count, hemoglobin level, mean platelet volume, and vitamin B_{12} and folate levels. The mean NLR was significantly higher in the patients than in the controls ($P < 0.05$). In conclusion, this study, which was the first to investigate the relationship between the NLR and peripheral vertigo, found that the NLR is significantly higher among peripheral vertigo patients than among healthy controls. This result suggests that the NLR is a novel potential marker of stress in peripheral vertigo patients.

1. Introduction

The vestibular system includes the parts of the inner ear and brain that process the sensory information involved with controlling balance and eye movement. Vertigo is the perception of movement either of the self or of the surrounding objects. It is a common clinical symptom, and is usually described as a rotational, spinning movement. The most commonly diagnosed vestibular disorders in patients with vertigo include Ménière's disease, benign paroxysmal positional vertigo (BPPV), vestibular neuritis, labyrinthitis, perilymph fistula and acoustic neuroma.

Vertigo, anxiety and stress tend to be concomitant, and attacks of vertigo seem to produce increased levels of stress-related hormones [1]. The total white blood cell (WBC) count and the counts of certain WBC subtypes are classic inflam-

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matory markers, especially, in patients with cardiovascular diseases [2]. The neutrophil-to-lymphocyte ratio (NLR) has been proposed as a reliable indicator of host inflammatory status and a potential marker of inflammation in cardiac and non-cardiac disorders [3–9].

In the present study, we compared NLRs between patients with peripheral vertigo and healthy subjects. To the best of our knowledge, this is the first study to evaluate the NLR in patients with peripheral vertigo.

2. Materials and methods

This prospective study included 103 patients who had had peripheral vertigo for at least 2 weeks and who presented to the Otolaryngology Department of Dumlupinar University Hospital. There were 71 women and 32 men; their mean age was 39.8 ± 14.7 years. All patients underwent detailed otolaryngologic and neurologic examinations in addition to audiometric tests to rule out any other pathology causing the vertigo. The audiograms of the patients were evaluated, and patients with moderate or severe hearing loss were excluded from study because of the stress impact of hearing loss on the patients. Vertigo patients with systemic diseases, neurological disorders, malignancy or any inflammatory disease, which could alter the NLR, were also excluded from the study.

In addition to the vertigo patients, we recruited age- and sex-matched healthy controls. The control subjects were selected from people who had visited the internal medicine department of our hospital for routine checkups and had been found to have no diseases. There were 103 control subjects (82 women, 21 men), with a mean age of 36.7 ± 13.5 years.

The study protocol was approved by the ethics committee of Pamukkale University. All subjects included in the study provided written informed consent. They were enrolled only after they agreed to participate in the study and signed an informed consent form.

Prevenipuncture blood samples were routinely drawn from the antecubital veins of all subjects by careful venipuncture. The samples were collected in EDTA tubes and used for determining the subjects' hemograms and full biochemistry profiles, including blood glucose level, liver-function tests, renal-function tests, lipid profiles, thyroid-function tests and vitamin status. The laboratory data were screened via a computerized database in our hospital, analyzed and compared between the patient and control groups. NLR was also calculated and compared between the two groups.

Statistical analysis was conducted using SPSS version 19 (SPSS, Chicago, IL). Normality was assessed using a Shapiro–Wilk test. For normally distributed values, descriptive results are expressed as mean ± SD. The independent-samples *t*-test and Kruskal–Wallis test were used to examine differences between groups. Statistical significance was defined as $P < 0.05$.

3. Results

The mean age of the patients was 39.8 ± 14.7 years; 69.4% of the patients were female, and 31.6% were male in the vertigo group and the mean age of the patients was 36.7 ± 13.5 years; 79.7% of the patients were female, and 20.3% were male in the control group.

There were no significant differences between the patient and control groups in terms of age, sex, lipid profile, liver-function tests, WBC count, hemoglobin level, mean platelet volume and vitamin B_{12} and folate levels (Table 1). The most common cause of vertigo was BPPV (66.9%), followed by Ménière's disease (11.6%), vestibular neuritis (9.7%) and other uncommon conditions such as temporal bone fracture (1.9%), Ramsay Hunt syndrome (0.9%) and idiopathic vertigo (8.7%). The mean NLR was significantly higher in the vertigo patients than in the control subjects ($P < 0.05$; Fig. 1). Higher NLR was due to higher neutrophil count in vertigo group than control group (Table 1).

4. Discussion

Peripheral vestibular disorders are limited to cranial nerve VIII and all distal structures. Patients with a peripheral disorder demonstrate nystagmus toward the side contralateral to the lesion responsible for the vertigo. Moreover, this nystagmus is suppressed with visual fixation, improves when the gaze is directed toward the lesion and worsens when the gaze is directed away from the lesion. Patients may also complain of a falling sensation. There are many causes of vertigo, according to study results of Orji [10], the most common ones are BPPV (52.5%), Ménière's disease (14.6%) and sudden idiopathic hearing loss (2.9%). Less common diagnoses are benign paroxysmal vertigo of childhood (0.7%),

Table 1 – Laboratory results in the peripheral vertigo and control groups.

Variable	Control group	Vertigo group	*P* value
Glucose (mg/d)	95.0 ± 9.9	98.9 ± 17.9	0.065
Total cholesterol (mg/d)	189.1 ± 35.0	196.9 ± 48.4	0.274
Triglyceride (mg/d)	120.9 ± 76.3	139.6 ± 71.2	0.129
HDL-cholesterol (mg/d)	53.5 ± 12.8	49.9 ± 13.3	0.107
LDL-cholesterol (mg/d)	111.6 ± 30.0	119.1 ± 40.4	0.221
Serum urea (mg/dL)	24.5 ± 7.1	25.9 ± 7.9	0.207
Creatinine (mg/dL)	0.73 ± 0.13	0.77 ± 0.19	0.053
AST (U/L)	19.5 ± 6.4	22.5 ± 17.3	0.157
ALT (U/L)	19.6 ± 12.0	21.4 ± 24.1	0.501
WBC count (1000/)	7.3 ± 1.8	7.7 ± 1.9	0.184
Hemoglobin level (g/dL)	13.5 ± 1.7	13.8 ± 1.7	0.122
Platelet count (10^3/mm^3)	254.9 ± 63.8	257.6 ± 60.4	0.764
Mean platelet volume (fl)	8.6 ± 1.3	8.7 ± 1.0	0.437
Neutrophil count (10^9/L)	4.2 ± 1.4	4.6 ± 1.5	0.092
Lymphocyte count (10^9/L)	2.4 ± 0.6	2.4 ± 0.8	0.928
Neutrophil/lymphocyte ratio	1.8 ± 0.6	2.2 ± 1.3	0.013
TSH (mU/l) (μIU/m)	2.2 ± 1.3	1.9 ± 1.1	0.079
FT4 (ng/dL)	1.23 ± 0.17	1.19 ± 0.20	0.147
Folate (ng/mL)	9.5 ± 3.2	8.8 ± 2.1	0.319
Vitamin B_{12} (pg/mL)	388.1 ± 245.9	328.8 ± 206.3	0.159

HDL, high-density lipoprotein; LDL, low-density lipoprotein; AST, aspartate aminotransferase; ALT, alanine aminotransferase; WBC, white blood cell; TSH, thyroid-stimulating hormone; FT4, free thyroxine.

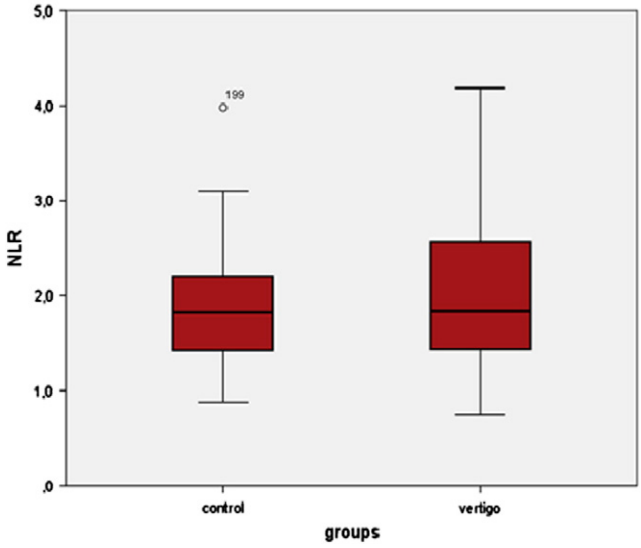

Fig. 1 – NLR values in the peripheral vertigo and control groups.

labyrinthitis (0.7%) and vestibular schwannoma (0.3%). Rare conditions that can cause vertigo are delayed endolymphatic hydrops, Ramsay Hunt syndrome, otosyphilis, vestibular neuritis, temporal bone fracture, post-concussion syndrome, cerebellar infarction, epilepsy and cervical vertigo [10]. In the present study also, the most common causes were BPPV Ménière's disease and vestibular neuritis. Symptoms such as nausea, vomiting, sweating and bradycardia are commonly seen in vertigo patients. The rate of recovery typically decreases with increasing severity and age, and improves with the use of vestibulo-suppressive medications.

WBC and specific lymphocyte subtypes have been found to be inflammatory markers in cardiovascular diseases. The NLR can be easily calculated from the neutrophil and lymphocyte counts in peripheral blood samples. It has been described as a novel potential marker of inflammation in cardiac and non-cardiac disorders [3–9]. Dogan et al. investigated the relationship between NLR and infarct-related arterial patency in patients with ST-segment elevation myocardial infarction. They reported that at admission, NLR was higher in patients with occluded infarct-related arteries than in patients with ST-segment elevation myocardial infarction [11]. NLR, in addition to being an important biomarker in cardiac disorders, is also a significant marker of some non-cardiac disorders such as Bell palsy. Ozler et al. investigated the relationship between NLR and Bell palsy, and concluded that there was a positive correlation between NLR values and the prognosis of facial paralysis [8].

NLR has been found to be an important index for predicting adverse clinical outcomes and a reliable marker in oncology. Seretis et al. [12] investigated the significance of NLR as a possible marker of underlying papillary microcarcinoma in goiter. They concluded that NLR was significantly elevated in patients with incidental papillary thyroid microcarcinomas and thyroid cancer. Jin et al. investigated the impact of NLR on the survival of patients with metastatic nasopharyngeal carcinoma. They found that NLR is a prognostic factor in patients with metastatic nasopharyngeal carcinoma [13].

A vicious circle of interaction seems to exist between somatic organic symptoms of Ménière's disease and the resultant psychological stress. This means that although stress can cause vertigo attacks, vertigo can also be the cause of stress; there is a strong co-existence. Attacks of vertigo can seem frightening to patients and are likely to produce and/or increase the level of anxiety, thereby worsening the emotional state of the patient. The resultant anxiety provokes various symptoms, probably through disorders of the autonomic nervous system, occasioned by the increased levels of stress-related hormones [1]. Goto et al. investigated somatic symptoms such as headache, insomnia, diarrhea, constipation, stomachache, chest pain, palpitations, dyspnea, general fatigue and stress in patients hospitalized due to dizziness or vertigo. They found that patients with dizziness or vertigo reported several somatic symptoms related to anxiety and depression, which were attributable to dizziness or vertigo. This underscores the need to treat these somatic symptoms when treating patients for dizziness or vertigo [14]. Dal-Lago et al. investigated the reasons vertigo patients do not feel "fully recovered" even after the treating professional has discharged them (2014). They claimed that anxiety was often a comorbid condition associated with peripheral vertigo; therefore, patients did not feel "fully recovered" even though they had been discharged after vertigo treatment. Anxiety affects the course of the illness and the probability of a full recovery [15].

It is well known that stress causes inflammation. Therefore, in this study, we investigated the relationship between peripheral vertigo and inflammation by means of the NLR. To the best of our knowledge, this is the first study to evaluate NLR in patients with peripheral vertigo. In the present study, we found a statistically significant relationship between NLR and peripheral vertigo, as compared with control subjects.

In conclusion, our result suggests that while evaluating peripheral vertigo patients, NLR should be taken into account as a novel potential marker. Increased NLR can be a candidate factor for monitoring patients with peripheral vertigo during follow-up. Further prospective and multi-center studies are required to confirm this relationship.

Conflict of interest

We do not have any financial relationship with the organization that sponsored the research.

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