



CLINICAL STUDY

DETERMINATION OF PREDICTORS FOR PERSISTENT POSTURAL- PERCEPTUAL DIZZINESS

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SUMMARY

Objective: The aim of this study was to determine the factors affecting recovery in patients presenting with acute dizziness and to determine possible predictors for persistent postural-perceptual dizziness (PPPD).

Materials and Methods: In this prospective study, 126 patients with acute dizziness were evaluated. Thirty-two patients (group 1) with dizziness resolved within three months and 31 patients (group 2) having the diagnosis of PPPD after three months were included in the study. The age and sex distribution of the two groups, smoking and alcohol use, history of falling due to imbalance, life styles, physical activity status, and whether they were diagnosed with anxiety, depression or migraine were compared.

Results: There was no significant difference between the two groups in terms of age distribution ($p=0.159$). The number of female patients was higher in the PPPD group ($p=0.004$). There was no significant difference between the two groups in terms of smoking and alcohol use ($p=0.649$, 0.656 , respectively). The number of patients with a history of falling due to imbalance, the number of patients not doing sports, the number of people not actively working, the number of people diagnosed with migraine, anxiety and depression were significantly higher in the PPPD group ($p<0.05$).

Conclusion: Female gender, fall, sedentary life, migraine, anxiety, and depression were found to be the predictors of PPPD. It was found that smoking and alcohol use and abnormal functional balance tests were not risk factors for PPPD in patients with imbalance.

Keywords: Dizziness handicap inventory, persistent postural-perceptual dizziness, vertigo, vestibular

İNATÇI POSTURAL ALGISAL DENGEŞİZLİK İÇİN ÖN BELİRLEYİCİLERİN SAPTANMASI ÖZET

Amaç: Bu çalışmanın amacı akut dengeşizlik şikayeti ile başvuran hastalarda iyileşmeyi etkileyen faktörleri saptamak ve inatçı postural algısal dengeşizlik (İPAD) için olası ön belirleyicileri saptamaktır.

Yöntem ve Gereçler: Bu prospektif çalışmada 126 akut dengeşizlik yakınması olan hasta değerlendirildi. Üç ay içinde dengeşizlik şikayeti düzelen 32 hasta (1. grup) ve üç aydan sonrada şikayetleri devam eden ve İPAD tanısı konulan 31 hasta (2. grup) çalışmaya dahil edildi. İki grubun yaş ve cinsiyet dağılımı, sigara ve alkol kullanımı, dengeşizliğe bağlı düşme öyküsü, yaşam tarzı, spor yapma yapıp yapmadıkları, anksiyete, depresyon veya migren tanısı alıp almadıkları karşılaştırıldı.

Bulgular: Yaş dağılımı açısından iki grup arasında anlamlı fark yoktu ($p=0.159$). Kadın hasta sayısı, İPAD hasta grubunda daha fazla idi ($p=0.004$). Sigara ve alkol kullanımı açısından iki grup arasında anlamlı fark yoktu ($p=0.649$, 0.656 , sırasıyla). Dengeşizlik nedeniyle düşme öyküsü olan hasta sayısı, spor yapmayan hasta sayısı, aktif olarak çalışmayan kişi sayısı, migren, anksiyete ve depresyon tanısı almış kişi sayısı İPAD grubunda anlamlı derecede fazla idi ($p<0.05$).

Sonuçlar: Kadın cinsiyet, düşme, sedanter yaşam, migren, anksiyete ve depresyon, İPAD için ön belirleyici olarak bulunmuştur. Dengeşizlik yakınması olan hastalarda sigara ve alkol kullanımı ve anormal fonksiyonel denge testlerinin İPAD için risk faktörü olmadığı bulunmuştur.

Anahtar Sözcükler: Dengeşizlik engellilik envanteri, inatçı postural algısal dengeşizlik, vertigo, vestibüler

INTRODUCTION

Dizziness is a common symptom in more than 25% of the general population^{1,2}. One in ten adults has various levels of dizziness and vertigo², while 2% have chronic dizziness³. This rate increases up to 20% in individuals over 60 years of age⁴. Dizziness is also associated with risk of falling, fear of falling and poor quality of life^{5,6}.

The most common cause of dizziness is peripheral vestibular problems. The damage of peripheral vestibular organs in both ears can cause dizziness. Over time these damages are

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compensated by the central nervous system and the complaints of dizziness disappear. However, dizziness may become a persistent and chronic problem in some patients⁷. Moreover, clinical examination of these patients and vestibular tests such as caloric test, head impulse test may be normal^{7,8}. This condition, called persistent functional dizziness, was also called phobic postural vertigo, visual vertigo and chronic subjective dizziness in previous years⁹. Recently, however, the Bárány Society has renamed these definitions as persistent postural-perceptual dizziness (PPPD)¹⁰. PPPD causes worsening dizziness and a sense of falling in the upright posture and complex visual stimuli⁹. Generally, symptoms of PPPD begin after acute attacks of vertigo, such as Meniere's disease, vestibular neuritis, and benign paroxysmal positional vertigo. However, the reasons for which dizziness has become permanent and the risk factors for PPPD are not fully known.

The aim of this study was to investigate the factors affecting recovery after acute dizziness and to determine the predictors for PPPD.

MATERIAL and METHODS

Patient selection

In this prospective study, patients admitted to the Otorhinolaryngology outpatient clinic with acute dizziness were evaluated. Detailed medical history was obtained from the patients and their demographic data were recorded. The questions in the data collection form applied to the patients included in the study were shown in Table 1. Ear, nose and throat examinations of all patients were performed before balance tests. Romberg test, Fukuda test, tandem stance test and tandem walking test were used to evaluate the functional balance skills of the patients. Gaze, saccade, smooth pursuit, and optokinetic tests were performed to evaluate the central vestibular systems of the patients. Head shake test, head thrust test and caloric test were performed to evaluate vestibulo-ocular reflexes. Dix-Hallpike test, supine roll test and deep head hanging test were used to evaluate the positional vertigo of the patients. Adult Dizziness Handicap Inventory Scale (ADHI) was used to subjectively evaluate the degree of dizziness disability of the

patients. All patients received 24 mg betahistine medication. Patients with musculoskeletal disorders, neurological disorders, abnormalities in blood parameters (anemia, hypothyroidism, etc.), and those with a systemic disease (hypertension, diabetes mellitus, etc.) were excluded from the study. Vertigo patients diagnosed as Meniere, vestibular neuritis, or benign paroxysmal positional vertigo were excluded from the study. A total of 126 patients with idiopathic acute dizziness who had no organic cause were included in the study. The patients were called for a follow-up visit three months later and the patients were re-evaluated with ADHI. Twenty-eight patients were excluded from the study because they could not be reached, 23 patients did not come to control, and 12 patients had acute vertigo attacks within three months. Thirty-two patients with an ADHI score of sixteen or less at the third month follow-up were included in the study as the group of patients whose dizziness improved during the acute phase (group 1). Thirty-one patients with an ADHI score of 18 or higher at the third month follow-up and meeting the Barany Society diagnostic criteria for PPPD were included in the PPPD group (group 2). Diagnostic criteria for PPPD were given in Table 2. The age and sex distributions of patients who have improved dizziness complaint (PIDC) in three months period and patients with PPPD were compared. Smoking and alcohol use, history of falling due to dizziness, active working in a job (students and employees were accepted as working actively; housewives and retirees were considered not to work actively), whether they were doing sports, whether they were diagnosed with anxiety, depression and migraine. Also, ADHI scores and functional balance skill test results (Romberg test, Fukuda test, tandem stance test and tandem walking test) of the patients in both groups were compared at the first admission. The study was approved by the ethics committee of Karabük University (2019-3/7). Written informed consent was obtained from all patients.

Adult Dizziness Handicap Inventory Scale (ADHI)

The scale consists of 25 questions including 9 questions about emotional status, 9



questions about functional status and 7 questions about physical status. Each question is given a score of 0 for no, 2 for sometimes and 4 for yes. The total score is calculated over 100 points. The total score of 0 to 16 is evaluated as there is no handicap, 16-34 as a mild handicap, 36-52 as intermediate handicap and 54-100 as an advanced handicap.

Oculomotor tests and Caloric test

Micromedical videonistagmography (VNG) device was used for oculomotor tests. The tests were performed in a specially designed and poorly lit balance room. Patients underwent VNG goggles. The eyes were transferred to the computer monitor by means of the angle adjustment in the VNG goggle, and the focus was adjusted for image sharpness. The light bar was placed in front of the patient and calibration was performed. All patients underwent ocular, saccade, smooth pursuit and optokinetic tests.

Aquastar air caloric device integrated into Micromedical VNG system was used for caloric test. The patients were placed in supine position on the stretcher and the head was flexed 30 degrees. The caps of the VNG goggles were closed to prevent fixation. The patients

underwent caloric test with a temperature of 27 degrees cold air and 47 degrees warm air for 80 seconds. At the end of the test, the nystagmus region with the highest and cleanest amplitude was selected. If the rate of slow phases of nystagmus in both ears were greater than 25%; it was considered to be normal.

Statistical analysis

SPSS 21.0 (SPSS software, SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Mean, standard deviation, median, minimum, maximum and percentage values were given as descriptive statistics. The t-test was used to evaluate the age distribution between the groups. Chi-square test was used to assess the presence of gender, smoking, fall, active living, sports, anxiety, depression and migraine between the groups. Fisher Exact test was used to evaluate alcohol use among the groups. Mann-Whitney U test was used to compare the ADHI scores applied to the patients at the time of admission. Chi-square test was used to compare abnormal Romberg test and abnormal tandem walking test results in both groups, Fischer Exact test was used to compare abnormal Fukuda test and abnormal tandem stance test results.

Table 1. Questions for patients in the data collection form

1.	How old are you?		
2.	Gender	Male	Female
3.	Do you smoke?	Yes	No
4.	Do you drink alcohol?	Yes	No
5.	Did you fall because of dizziness?	Yes	No
6.	Do you do sports?	Yes	No
7.	Are you actively working?	Yes	No
8.	Have you been diagnosed with migraine?	Yes	No
9.	Have you been diagnosed with anxiety?	Yes	No
10.	Have you been diagnosed with depression?	Yes	No



Table 2. Diagnostic criteria for persistent postural-perceptual dizziness (PPPD). There should be all five criteria for the diagnosis of PPPD.

1. There should be at least one of the symptoms of dizziness, unsteadiness, or non-spinning vertigo on most days at least three months. Symptoms last for prolonged periods of time, but may wax and wane in severity. Symptoms do not need to be present all day long.
2. Symptoms may occur without specific provocation. Symptoms can be triggered by standing upright, the patient's own movements, exposure to moving visual stimuli, or complex visual patterns.
3. The disorder is triggered by events that cause vertigo, unsteadiness, dizziness, or problems with balance, acute, episodic or chronic vestibular syndromes, other neurological or medical illnesses, and psychological distress.
4. Symptoms cause significant distress or functional impairment.
5. Symptoms are not better explained by any other disease or disorder.

RESULTS

There was no significant difference in age distribution between the PIDC group (n = 32) and the patient group (n=31) diagnosed with PPPD (p=0.159). When the gender distribution between the two groups was examined, it was significant that the female gender was higher in the PPPD patient group (p=0.004). The age and gender distribution of the groups are given in Table 3.

There was no significant difference between PIDC group and PPPD group in terms of smoking and alcohol use (p=0.649, p=0.656, respectively). The number of patients with a history of falls due to dizziness, the number of

patients not doing sports, the number of patients not actively working, and the number of patients diagnosed with migraine, anxiety and depression were significantly higher in the PPPD group (Table 4).

According to the ADHI scores at admission, the mean ADHI score in the PIDC group was 51.81±17.04 and the mean ADHI score in the PPPD group was 38.00±17.44. The ADHI score was significantly higher in the PPPD group than in the PIDC group (p=0.002). There was no significant difference between the results of Fukuda test, Romberg test, tandem stance test and tandem walking test at the time of admission in both groups (Table 5).



Table 3. Age and gender distribution of PIDC and PPPD patients

	PIDC (n=32)	Patients with PPPD (n=31)	P-value
Age (mean±SD)	39.97±12.86	45.00±15.09	0.159 ^a
Sex (male/female)	16/16	26/5	0.004 ^b

PIDC: patients who have improved dizziness complaint, PPPD: persistent postural-perceptual dizziness, ^a t-test, ^b chi-square test

Table 4. Demographic data of PIDC and PPPD patient groups

	PIDC		Patients with PPPD		p-value
	(n=32)		(n=31)		
	n	%	n	%	
Smoking	11	34.4	9	29.0	0.649 ^a
Alcohol using	3	9.4	4	12.9	0.656 ^b
Falling	2	6.3	13	41.9	0.001 ^a
Doing sports	14	43.8	2	6.5	0.001 ^a
Active working	20	62.5	9	29.0	0.008 ^a
Migraine	2	6.3	14	45.2	0.000 ^a
Anxiety	2	6.3	9	29.0	0.017 ^a
Depression	1	3.1	10	32.2	0.002 ^a

PIDC: patients who have improved dizziness complaint, PPPD: persistent postural-perceptual dizziness, ^a chi-square test, ^b Fisher exact test



Table 5. Abnormal functional balance test results in PIDC and PPPD patient groups

Balance tests	PIDC		Patients with PPPD		p-value
	(n=32)		(n=31)		
	n	%	n	%	
Romberg test	2	6.3	3	9.8	0.672 ^b
Fukuda test	10	31.3	15	48.4	0.165 ^a
Tandem stance test	14	43.8	21	67.7	0.055 ^a
Tandem walking test	4	12.5	5	16.1	0.732 ^b

PIDC: patients who have improved dizziness complaint, PPPD: persistent postural-perceptual dizziness, ^a Chi-square test, ^b Fisher Exact test

DISCUSSION

The aim of this study was to investigate the factors affecting recovery after acute dizziness and to determine PPPD risk factors for patients. At the end of the study, it was found that people diagnosed with migraine, anxiety and depression, who had a history of falling due to dizziness, sedentary individuals and women were more likely to develop PPPD. High ADHI score was also found to be a risk factor for PPPD.

The relationship between dizziness and psychiatric disorders such as anxiety and depression can be explained by neuro-anatomical connections. Amygdala, insula, anterior cingulate, prefrontal cortex, superior frontal gyrus, para-cingulate, and inferior frontal gyrus are responsible for anxiety, depression and fear¹¹. These structures are also in connection with the central vestibular system. Thus, a dysfunction in these structures can cause both anxiety and dizziness. In our study, we also found that patients without psychological disorders such as anxiety and depression may also have a higher probability of PPPD if they have a history of falling due to dizziness. Holloway et al¹² in their study, reported that falling individuals have more anxiety disorders than non-falling individuals. The fact that

patients with a history of falls due to dizziness is more risky for PPPD may be associated with more anxiety and depression in these individuals.

Tests evaluating vestibulo-spinal reflex, such as Fukuda test, tandem test, and Romberg test, are often used to assess the functional balance skills of dizziness patients. These tests give clinicians important information about their ability to provide stability in dynamic and static movements that patients face in daily life. In this study, there was no significant difference in terms of dynamic and static balance tests applied to the groups at the time of first admission. This result does not indicate that patients who present with complaints of dizziness are difficult to heal in the acute period of three months or there is a risk of developing PPPD although they have abnormalities in Romberg test, tandem posture test and tandem gait test. In short, we think that abnormal dynamic and static balance test results are not risk factors for PPPD.

PPPD can be defined as a chronic functional disorder that lasts at least 3 months and the characteristic features of the disease has been identified as¹³: worsening of symptoms with standing, head movements and complex visual stimuli, persistent instability in physical examination, presence of emotional shock or



illness at the onset of symptoms, concurrent diseases and anxiety. Nada et al¹⁴ investigated the efficacy of vestibular rehabilitation program in their study on PPPD patients. They reported that the vestibular rehabilitation program improves the physical and functional status of patients with PPPD and improves their quality of life. However, they reported no emotional improvement in these patients. In another study, Holmberg et al¹⁵ applied both vestibular rehabilitation program and cognitive behavioral therapy to PPPD patients. At the end of the study, they reported a significant improvement in their complaints and improved quality of life in patients with PPPD. In our study, it was found that individuals who are actively working and doing sports are less likely to have PPPD. Daily life includes many exercises such as oculomotor, adaptation and balance fitness exercises. Therefore, vestibular compensation may be improved more rapidly and adequately in these patients. In addition, it is known that psychological problems are seen more in sedentary individuals.

Bittar et al¹¹ reported that the second most common additional disease in PPPD patients was migraine with a rate of 26%. In our study, 45.1% of patients with PPPD also had migraine. The relationship between PPPD and migraine has been reported to be the same as the main triggers in both diseases^{16,17}. Furthermore, in our study, similar to the literature^{11,18}, we found that female have a higher risk of PPPD than men. The higher incidence of PPPD in female may be that they are more sedentary than male patients due to the fact that most of the female patients included in our study are housewives and do not play sports, and therefore they are exposed to less stimuli and vestibular compensation mechanism does not develop adequately. In addition, anxiety is more common in women¹⁹. Migraine pains peak in the fourth and fifth decades due to women's menopause and hormonal changes^{16,17}. In this case, it may be a factor in the higher incidence of PPPD in female. In our study, the mean age of the patients with PPPD was 45.00±15.09. We also investigated the effect of smoking and alcohol on PPPD. However, our study revealed that smoking and alcohol were not a risk factor for PPPD.

However, larger sample size and cohort studies are needed for more specific results.

In conclusion, female gender, sedentary life, migraine, anxiety and depression were found to be risk factors for PPPD in our study. Patients with a history of falls due to imbalance developed more PPPD than patients without history of falling. There was no correlation between smoking and alcohol use and PPPD. The high ADHI score applied to patients at the time of first admission was found to be a predictor of PPPD. Acute dizziness patients with these risk factors should be considered as candidates for long-term PPPD. These patients should be advised to do sports and prefer a more active lifestyle. If necessary, early vestibular rehabilitation may be applied to these patients to provide vestibular adaptation.

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