

Prevalence, etiology, and biopsychosocial risk factors of cervicogenic dizziness in patients with neck pain: A multi-center, cross-sectional study

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ABSTRACT

Objectives: This study aims to investigate the prevalence, etiology, and risk factors of cervicogenic dizziness in patients with neck pain.

Patients and methods: Between June 2016 and April 2018, a total of 2,361 patients (526 males, 1,835 females; mean age: 45.0±13.3 years; range, 18 to 75 years) who presented with the complaint of neck pain lasting for at least one month were included in this prospective, cross-sectional study. Data including concomitant dizziness, severity, and quality of life (QoL) impact of vertigo (via Numeric Dizziness Scale [NDS]), QoL (via Dizziness Handicap Inventory [DHI]), mobility (via Timed Up-and-Go [TUG] test), balance performance [via Berg Balance Scale [BBS]), and emotional status (via Hospital Anxiety-Depression Scale [HADS]) were recorded.

Results: Dizziness was evident in 40.1% of the patients. Myofascial pain syndrome (MPS) was the most common etiology for neck pain (58.5%) and accompanied with cervicogenic dizziness in 59.7% of the patients. Female versus male sex (odds ratio [OR]: 1.641, 95% CI: 1.241 to 2.171, p=0.001), housewifery versus other occupations (OR: 1.285, 95% CI: 1.006 to 1.642, p=0.045), and lower versus higher education (OR: 1.649-2.564, p<0.001) significantly predicted the increased risk of dizziness in neck pain patients. Patient with dizziness due to MPS had lower dizziness severity scores (p=0.034) and milder impact of dizziness on QoL (p=0.005), lower DHI scores (p=0.004), shorter time to complete the TUG test (p=0.001) and higher BBS scores (p=0.001).

Conclusion: Our findings suggest a significant impact of biopsychosocial factors on the likelihood and severity of dizziness and association of dizziness due to MPS with better clinical status.

Keywords: Balance, cervicogenic dizziness, handicap, myofascial pain syndrome, neck pain.

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Neck pain and dizziness (including vertigo and non-vestibular dizziness) rank among the most common complaints in medical practice.^[1-3] The simultaneous presence of neck pain and cervicogenic dizziness is frequent and considered to occur via a causal rather than a coincidental relationship.^[4,5]

Cervicogenic dizziness refers to a non-specific sensation of altered orientation in space and disequilibrium causing erroneous proprioceptive information and a sensory mismatch between vestibular and cervical inputs.^[2,4,6-9] However, among the various causes of dizziness, cervicogenic dizziness has long been a controversial entity with no consensus regarding its pathophysiology, diagnostic criteria, and optimal treatment.^[2,8,10,11] There is no diagnostic method or specific test to link the patient's dizziness to underlying neck condition.^[10-12]

In the literature, there is only a limited number of data about the prevalence of cervicogenic dizziness, while the diagnosis is usually based on exclusion of vestibular disorders and presence of correlating symptoms of imbalance and dizziness with neck pain.^[2,6,9,10,13] In the present study, we aimed to determine prevalence and etiology of cervicogenic dizziness and to identify potential sociodemographic, clinical, and psychological risk factors for vertigo in patients with neck pain.

PATIENTS AND METHODS

Study design and study population

This multi-center, prospective, cross-sectional study was conducted at Physical Medicine & Rehabilitation (PMR) clinics across Turkey between June 2016 and April 2018. A total of 2,361 patients (526 males, 1,835 females; mean age: 45.0±13.3 years; range, 18 to 75 years) who presented with the complaint of neck pain lasting for at least one month were included. Age between 18 and 75 years, literacy and having neck pain for at least one month were the inclusion criteria of the study, while patients with psychiatric, neurological, cardiac (medical history or electrocardiographic abnormality) or rheumatological disorder, congenital anomalies of cervical region, vestibular pathologies with neck pain and stiffness (i.e., labyrinthine concussion, vestibular migraines), other etiologies accompanying myofascial pain syndrome (MPS), previous craniocervical surgery, organic pathology of the vertebrobasilar system, concomitant middle ear pathology or medication usage associated with risk of dizziness, mass lesions in brain or spinal medulla, malignancy, pregnancy, and dizziness episodes

accompanied with extensive vomiting were excluded from the study. A written informed consent was obtained from each patient. The study protocol was approved by the Ethics Committee of Bakırköy Dr. Sadi Konuk Training Hospital, (No: 2016/03/04 , Date: 11.04.2016). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data collection

Data including sociodemographic characteristics, etiology and duration of neck pain, presence of concomitant dizziness were recorded. A detailed physical examination including locomotor system and neurological examination, presence of trigger points associated with MPS-related vertigo (i.e., sternocleidomastoid and trapezius muscles), as well as check of range of motion across cervical vertebrae through neck assessment was performed. Previous imaging findings on cervical spine X-ray and cervical magnetic resonance imaging were reviewed for conditions such as spondylosis or disc herniation. Biopsychosocial assessment regarding the severity and quality of life (QoL) impact of vertigo (via Numeric Dizziness Scale [NDS]), QoL (via Dizziness Handicap Inventory [DHI]), mobility (via Timed Up-and-Go [TUG] test), balance performance [via Berg Balance Scale [BBS]), and emotional status (via Hospital Anxiety-Depression Scale [HADS]) was performed by PMR specialists experienced in vestibular rehabilitation. Baseline characteristics, clinical, and biopsychosocial findings were evaluated according to presence, etiology and severity of dizziness, while risk factors for dizziness presence in patients with neck pain were also analyzed.

Numeric Dizziness Scale

The severity of vertigo and the impact of vertigo on QoL were assessed by a 10-point NDS with higher scores indicating higher severity of vertigo and marked impact on QoL.

Timed Up-and-Go test

The 3-m TUG test was used as a performance-based test of the functional mobility and the risk of falling. The participant is asked to rise from a seated position in a chair and walk a distance of 3 m, turn around and return to a sitting position as quickly and safely as possible. Time is recorded by the nearest time of the person's buttocks leave the chair until return contact with the chair. The shorter time indicates better physical performance, while the test is considered to have good predictive ability and diagnostic accuracy in discriminating fallers from non-fallers.^[14,15]

TABLE 1
Demographic and clinical characteristics according to the presence and etiology of dizziness

	Total (n=2,361)		Dizziness		Etiology of dizziness (n=947)		p ¹
	Present (n=947)	Absent (n=1,414)	Present (n=947)	Absent (n=1,414)	MPS (n=565)	Other (n=382)	
Age (year) [Mean±SD, median (min-max)]	45.0±13.3 45 (18-75)	47.2±13.0 47(18-75)	43.6±13.4 43(18-75)	45.2±12.6 45 (18-75)	49.9±13.2 51 (18-75)	0.001 ²	0.001 ²
Sex, n (%)							
Female	1835 (77.7)	806 (43.9)	1029 (56.1)	483 (59.9)	323 (40.1)	0.693	
Male	526 (22.3)	141 (26.8)	385 (73.2)	82 (58.2)	59 (41.8)		
Occupation, n (%)							
Desk job	270 (11.4)	78 (28.9)	192 (71.1)	52 (66.7)	26 (33.3)	0.031 ⁴	
Long hours with the same neck position	254 (10.8)	76 (29.9)	178 (70.1)	48 (63.2)	28 (36.8)		
Housewife	1114 (47.2)	558 (50.1)*	556 (49.9)	324 (58.1)	234 (41.9)		
Retired	254 (10.7)	101 (39.8)	153 (60.2)	48 (47.5) *	53 (52.5)		
Employee	272 (11.5)	89 (32.7)	183 (67.3)	61 (68.5)	28 (31.5)		
Officer	158 (6.7)	39 (24.7)	119 (75.3)	28 (71.8)	11 (28.2)		
Student	39 (1.7)	6 (15.4)	33 (84.6)	4 (66.7)	2 (33.3)		
Educational status, n (%)							
Literate, not educated	182 (7.7)	88 (48.4)	94 (51.6)	42 (47.7)	46 (52.3)	0.001	
Primary school	872 (36.9)	430 (49.3)	442 (50.7)	238 (55.3)	192 (44.7)		
Secondary school	696 (29.5)	261 (37.5)	435 (62.5)	172 (65.9)*	89 (34.1)		
Higher education	611 (25.9)	168 (27.5)*	443 (72.5)	113 (67.3)*	55 (32.7)		
Etiology of neck pain, n (%)†							
Myofascial pain syndrome	1381 (58.5)	583 (61.6)	798 (56.4)	0.013			
Cervical disc hernia	848 (35.9)	356 (37.6)	492 (34.8)	0.165			
Cervical spondylosis	613 (26.0)	282 (29.8)	331 (23.4)	<0.001			
Other‡	122 (5.2)	67 (7.1)	55 (3.9)	<0.001			
Duration of neck pain (month)	36.2±46.4	43.6±50.7	31.3±43.0	0.001 ³			
[Mean±SD, median (min-max)]	20 (1-480)	24 (1-360)	12 (1-480)				
Concomitant dizziness, n (%)	947 (100.0)	947 (100.0)	0 (0.0)				
Etiology of cervicogenic dizziness							
Sternocleidomastoid muscle trigger point							
Unilateral					83 (8.8)		
Bilateral					94 (9.9)		
Trapezius muscle trigger point							
Unilateral					112 (11.8)		
Bilateral					345 (36.4)		
Migraine-related					46 (4.9)		
Psychogenic					120 (12.7)		
Transient ischemia of vertebral artery					14 (1.5)		
Sympathetic dysfunction					36 (3.8)		
Proprioceptive cervical dizziness					126 (13.3)		
Other					72 (7.6)		
Etiology group							
Myofascial pain syndrome					565 (59.7)		
Other					382 (40.3)		

† Multiple choices were possible; ‡ Whiplash associated disorder, degenerative disc diseases, cervical facet joint syndrome; † Pearson chi-square test; ‡ Student t-test; † Mann-Whitney U test; * p<0.01 compared to other occupations or education levels.

Dizziness Handicap Inventory

The DHI, developed by Jacobson and Newman,^[16] is a 25-item instrument used for self-assessment of disability due to dizziness. It consists of three sub-domains including functional (9 items), physical (7 items), and emotional (9 items) domains. Each item is scored based on a 1-3 Likert scale (0: no, 2: sometimes, 4: yes) that yields the functional, physical and emotional domain scores in a range of 0-36, 0-28 and 0-36, respectively and a total score of 0-100. Higher scores indicate a greater degree of impairment.^[16,17] The reliability and validity of Turkish version of DHI were conducted by Ellialtioglu et al.^[18]

Berg Balance Scale

The BBS is a 14-item tool designed by Berg et al.^[19] and Berg et al.^[20] to measure functional balance. The total score of BBS ranges from 0 to 56, and greater scores indicate better balance. The results are categorized as balance disorder (scores 0-20), acceptable balance (scores 21-40) and good balance (scores 41-56).^[19,20] The reliability and validity of Turkish version of DHI were conducted by Sahin et al.^[21]

Hospital Anxiety and Depression Scale

The HADS, developed by Zigmond and Snaith,^[22] is a 14-item (seven related to anxiety [HADS-A] and seven related to depression [HADS-D]) scale used to screen anxiety and depression in medical outpatient settings.^[22,23] Each item on the questionnaire is scored from 0-3 leading overall score to range between 0 and 21 for either anxiety or depression as categorized into normal (scores 0-7), borderline abnormal (scores 8-10) and abnormal (scores 11-21) status.^[22,23] The HADS was adapted to Turkish by Aydemir^[24] with cut-off points of 10 and 7 defined for HADS-A and HADS-D subscales, respectively.

Statistical analysis

Statistical analysis was performed using the NCSS version 2007 software (NCSS LLC, Kaysville, UT, USA). Descriptive data were expressed in mean \pm standard deviation (SD), median (min-max) or number and frequency, where applicable. The Pearson chi-square (χ^2) test, Fisher-Freeman-Halton test and Fisher exact test were used to compare categorical data, while numerical data were analyzed using the Student t-test for variables with normal distribution and with Mann-Whitney U and Kruskal Wallis tests for non-normally distributed variables. Backward stepwise logistic regression analysis was performed to identify factors associated with the increased risk

for dizziness in patients with neck pain. Correlation analysis was performed using the Pearson correlation analysis. A *p* value of <0.05 was considered statistically significant with 95% confidence interval (CI).

RESULTS

Demographic and clinical characteristics

The majority of the participants were housewives, while 36.9% of participants were primary school graduates. Neck pain was due to MPS in 58.5% of patients. Concomitant dizziness was evident in 947 (40.1%) patients (Table 1). The presence of dizziness was associated with the increasing age (47.2 ± 13.0 vs. 43.6 ± 13.4 , respectively; $p=0.001$), a higher rate of females (43.9 vs. 26.8% , respectively; $p=0.001$), a higher likelihood of housewifery than other occupations ($p=0.001$), a lower rate of higher education (27.5 vs. 72.5% , respectively; $p<0.01$), longer duration of neck pain (43.6 ± 50.7 vs. 31.3 ± 43.0 months, respectively; $p=0.001$) and a higher likelihood of MPS (61.6 vs. 56.4% , respectively; $p=0.013$) in the etiology of neck pain (Table 1).

Overall, cervicogenic dizziness was accompanied with MPS in 59.7% of the patients. In patients with dizziness ($n=947$), those with dizziness due to MPS versus other reasons aged younger (45.2 ± 12.6 vs. 49.9 ± 13.2 years, respectively; $p=0.001$), had a lower rate of retirement (47.5 vs. 52.5% , respectively; $p=0.031$) and a higher rate of secondary (65.9 vs. 34.1% , respectively; $p=0.001$) or higher education (67.3 vs. 32.7% , respectively; $p=0.001$) (Table 1).

Biopsychological findings

Presence versus absence of dizziness was associated with a higher likelihood of presence of sternocleidomastoid muscle trigger point (44.4 vs. 24.6% , respectively; $p=0.001$), longer time to complete the TUG test (11.1 ± 4.7 ; range, 3 to 92 vs. 7.7 ± 3.8 ; range, 3 to 25 sec, respectively; $p=0.001$), lower BBS scores (poorer balance; 51.1 ± 6.0 vs. 55.6 ± 1.5 , respectively; $p=0.001$) and higher HADS-D scores (8.6 ± 6.1 vs. 6.8 ± 5.8 , respectively; $p=0.002$) (Table 2).

In patients with dizziness ($n=947$), those with dizziness due to MPS versus other reasons had lower DHI scores (lesser impairment; 33.7 ± 20.2 vs. 37.6 ± 20.8 , respectively; $p=0.004$), shorter time to complete the TUG test (10.5 ± 4.8 vs. 11.9 ± 4.3 sec, respectively; $p=0.001$), higher BBS scores (better balance; 51.5 ± 5.8 vs. 50.5 ± 6.1 , respectively; $p=0.001$) and similar HADS scores (Table 2).

TABLE 2
Clinical and biopsychological findings in patients with neck pain according to presence and etiology dizziness

	Dizziness			Etiology of dizziness (n=947)		
	Present (n=947)	Absent (n=122)	p	MPS (n=565)	Other (n=382)	p
Sternocleidomastoid muscle trigger point (MPS)§			0.001 ¹			-
Right	84 (8.9)	6 (4.9)		-	-	
Left	163 (17.2)	13 (10.7)		-	-	
Bilateral	173 (18.3)	11 (9.0)		-	-	
None	527 (55.6)	92 (75.4)		-	-	
Trapezius muscle trigger point (MPS)§			0.267 ¹			-
Right	119 (12.6)	17 (13.9)		-	-	
Left	165 (17.4)	19 (15.6)		-	-	
Bilateral	568 (60.0)	67 (54.9)		-	-	
None	95 (10.0)	19 (15.6)		-	-	
Dizziness handicap Inventory (DHI)¶	35.3±20.5 32 (0-100)	- -	-	33.7±20.2 30 (0-98)	37.6±20.8 36 (0-100)	0.004 ²
Timed Up-and-Go (TUG) test (sec)¶	11.1±4.7 10 (3-92)	7.7±3.8 7 (3-25)	0.001 ²	10.5±4.8 10 (3-92)	11.9±4.3 11 (3-49.5)	0.001 ²
Berg Balance Scale (BBS)¶	51.1±6.0 53 (0-64)	55.6±1.5 56 (48-56)	0.001 ³	51.5±5.8 53 (15-56)	50.5±6.1 52 (0-64)	0.001 ³
HADS-anxiety (n=944)¶	8.21±5.27 7 (0-36)	7.75±5.27 8 (0-21)	0.363 ²	8.3±5.4 8 (0-33)	8.0±5.0 7 (0-36)	0.377 ²
HADS-depression (n=944)¶	8.57±6.12 7 (0-34)	6.77±5.84 6 (0-37)	0.0022	8.40±6.23 7 (0-33)	8.82±5.96 8 (0-34)	0.340 ²

MPS: Myofascial pain syndrome; DHI: Dizziness Handicap Inventory; TUG: Timed Up-and-Go; BBS: Berg Balance Scale; HADS: Hospital Anxiety and Depression Scale; § n (%); ¶ Mean±SD, median (min-max); ¹ Pearson chi-square test; ² Student t-test; ³ Mann-Whitney U test.

TABLE 3
Features of dizziness (n=947)

	Total (n=947)	MPS (n=565)	Etiology of dizziness Other (n=382)	p ¹
Duration (month)¶	24.7±35.2 12 (1-240)	23.2±34.4 12 (1-240)	26.9±36.4 12 (1-240)	0.047 ²
Course (min)¶	7.9±69.8 0.33 (0.02-1440)	7.7±65.4 0.3 (0-1440)	8.3±75.9 0.5 (0-1440)	0.437 ²
NDS scores¶				
Severity	4.4±2.0 4 (0-10)	4.3±2.0 4 (0-10)	4.6±2.0 4 (0-9)	0.034 ²
Impact on QoL	3.7±2.2 3 (0-10)	3.6±2.1 3 (0-10)	4.0±2.2 4 (0-10)	0.005 ²
Presence of motion sickness§	222 (23.4)	131 (23.2)	91 (23.8)	0.821
Concomitant nausea§	242 (25.6)	128 (22.7)	114 (29.8)	0.040
Concomitant vomiting§	56 (5.9)	39 (6.9)	17 (4.5)	0.117
Triggering or aggravating factors*§				
None	124 (13.1)	76 (13.5)	48 (12.6)	0.692
Head movement (rotation, backward)	310 (32.7)	175 (31.0)	135 (35.3)	0.160
Migraine	99 (10.5)	59 (10.4)	40 (10.5)	0.989
Standing up quickly	580 (61.2)	351 (62.1)	229 (59.9)	0.500
Body movement	756 (79.8)	448 (79.3)	308 (80.6)	0.615
Stress	640 (67.6)	366 (64.8)	274 (71.7)	0.025
Other	73 (7.7)	42 (7.4)	31 (8.1)	0.700

MPS: Myofascial pain syndrome; NDS: Numeric Dizziness Scale; QoL: Quality of life; § n (%); ¶ Mean±SD, median (min-max); * Multiple choices were possible; ¹ Pearson chi-square test; ² Mann-Whitney U test.

TABLE 5
Logistic regression analysis for factors associated with the increased risk for dizziness in patients with neck pain (n=2,361)

	OR	%95 CI		p
		Lower bound	Upper bound	
Sex (female vs. male)	1.641	1.241	2.171	0.001
Educational status (vs. higher education)	2.410	1.587	3.661	<0.001
Literacy, no education	2.564	1.926	3.413	<0.001
Primary education	1.649	1.242	2.188	0.001
Secondary education	1.285	1.006	1.642	0.045
Occupational status (housewifery vs. others)	1.285	1.006	1.642	0.045

Backward stepwise logistic regression analysis. CI: Confidence interval; OR: Odds ratio.

CI: 1.926 to 3.413, $p < 0.001$) and secondary education (OR: 1.649, 95% CI: 1.242 to 2.188, $p = 0.001$) versus higher education were associated with a significantly increased risk of dizziness in patients with neck pain (Table 5).

DISCUSSION

Our findings revealed the presence of concomitant cervicogenic dizziness in 40% of neck pain patients and indicated MPS as the most common etiology for both neck pain and concomitant cervicogenic dizziness. The presence versus absence of dizziness was associated with poorer functional mobility, poorer balance and a depressive state, while the increase in dizziness severity was associated with higher dizziness-related handicap and poorer balance.

Similarly, previous studies revealed the presence of concomitant dizziness in 35% patients with neck pain,^[25] as well as more severe disability and increased pain intensity in chronic cervical pain patients with versus without concomitant dizziness.^[26] Posturographic studies also revealed abnormal static and dynamic balance parameters in chronic neck pain patients suffering from dizziness, along with a correlation between functional complaints and posturographic parameters.^[25,27,28] Dizziness symptoms have also been associated with impaired cervical proprioception secondary to neck pain,^[25] while the severity of vertigo symptoms was reported to be correlated with the degree of vertigo-related handicap.^[29-31]

Association of higher HADS scores with the increased dizziness severity in our cohort support the consideration of psychological distress related to anxiety and depression to be a relevant mediator between dizziness symptoms and dizziness-related

handicap.^[29,31-33] This emphasizes the role of routine psychological assessment in patients with dizziness in terms of the potential role of treating psychological distress in limiting the effect of the dizziness symptoms on handicap.^[29]

According to our findings, the factors increasing the likelihood of dizziness (female sex, older age, lower educational level and longer symptom duration) seem also to decrease the likelihood of MPS-related dizziness or to increase severity of dizziness. Besides, the presence of MPS seems also to be associated with a less severe dizziness with lesser impact on QoL, lesser disability, better functional mobility and better balance status. This seems to emphasize that not all patients suffering from dizziness symptoms develop handicap. Better clinical course seems likely in males, in those with MPS etiology, younger age and higher education in terms of severity of dizziness, handicap due to dizziness and balance problems. Given the likelihood of underlying etiology and certain biopsychosocial factors to be involved in the presence and worsening of vertigo in chronic neck patients, our findings indicate the importance of screening for dizziness, particularly in patients at a higher risk for increased dizziness-related handicap. Our findings also support the episodic nature (lasting minutes to hours) and typical symptoms (cervical pain, vertigo or dizziness, imbalance) of cervicogenic dizziness, as considered to fit the definition of imbalance rather than an illusory perception of rotational or linear movement.^[6,9-12] Additionally, the mean DHI scores in our patients with dizziness are consistent with the association of cervicogenic dizziness with mild disability and better clinical course than vestibular pathologies.^[34-36]

Identification of MPS that originates from trigger points as the most common etiology for the neck pain

and to be frequently accompanied with cervicogenic dizziness in our cohort seem to support a neck-related cause for certain episodes of dizziness owing to the principal role of the cervical spine in maintenance of posture.^[25] This seems also notable given the consideration of MPS as the most frequent, but at the same time the most often under-diagnosed or misdiagnosed pain condition, despite the availability of effective therapeutic interventions for MPS when properly identified.^[37]

In a previous study among 72 patients with cervicogenic dizziness, MPS in the face, neck and shoulders was reported in 97% of patients along with improvement in dizziness symptoms via treatment for MPS in 70% patients.^[13] The authors also noted a significant difference in the distribution of trigger points between cervicogenic dizziness patients and MPS patients without dizziness, with a higher rate of trigger points in the lateral neck muscles and involvement of sternocleidomastoid muscle only among cervicogenic dizziness patients. In addition, they indicated similarly high rates for upper trapezius muscle and cervical paraspinal muscle involvement in cervicogenic dizziness patients and MPS patients without dizziness. This seems to be consistent with the identification of trigger points most commonly in the trapezius muscle in our neck patients regardless of the concomitant dizziness, whereas higher rates of bilateral sternocleidomastoid muscle trigger point in MPS among neck pain patients with versus without dizziness. Therefore, our findings support the development of dizziness via muscles that have trigger points and frequent involvement of cervical and shoulder regions, sternocleidomastoid muscle, in particular, among MPS cases with concomitant vertigo.^[13,38,39]

Notably, an outpatient rehabilitation program focusing on cervical pain in patients with chronic cervical MPS and concurrent dizziness was reported to be associated with an average Visual Analog Scale (VAS) improvement in dizziness, pain and function in 59%, 69% and 71% of patients, respectively with no further episodes of dizziness in 27% of patients.^[40]

In a study among 32 patients with MPS involving trigger points at the clavicular division of the sternocleidomastoid muscle and concomitant non-rotatory vertigo, 10 sessions of superficial heat application and stretching on the sternocleidomastoid muscle was reported to be associated with complete disappearance of dizziness complaints in 13 patients, while complaints were decreased by 50% in 19

patients.^[39] Thus, our findings support that assessment for MPS should be integrated into the routine physical examination of the neck pain patients,^[39] as a common and treatable etiology underlying both neck pain and concomitant dizziness.

The major strength of this study seems to be inclusion of the representative sample of neck pain patients as recruited from 19 centers across Turkey increasing the likelihood of generalizability of our findings. However, certain limitations to this study should be considered. First, data on clinical and biopsychological tests were available in relatively small number of patients without cervicogenic dizziness, which otherwise would extend the knowledge achieved in the current study. Second, while patients from different PMR centers across Turkey were involved, the potential impact of geographic differences on dizziness symptoms was not analyzed. Third, the majority of the study population consisted of females, while this is consistent with the demographic characteristics in real-life clinical practice across PMR outpatient clinics in our country. Indeed, the predominance of females among the outpatients admitting with neck pain and myofascial pain syndrome has been reported previously in studies from Turkey.^[41,42] Nevertheless, despite these certain limitations, given the paucity of the solid information available on this area, our findings represent a valuable contribution to the literature.

In conclusion, our findings suggest the presence of cervicogenic dizziness in nearly half of neck pain patients with a significant impact of certain biopsychosocial factors on the likelihood (female sex, housewifery, and lower educational level) and severity (underlying etiology, older age, female sex, educational level, higher psychological distress) of concomitant dizziness. In addition, MPS was the most common etiology for both neck pain and frequently accompanied with dizziness, while it was associated with better clinical status in terms of dizziness severity, dizziness-related handicap, functional mobility, and balance status. Accordingly, our findings emphasize the importance of screening for concomitant dizziness in routine investigation of neck pain patients and screening for MPS and psychological distress in those with dizziness, in terms of potential benefit from targeted therapeutic interventions to improve dizziness symptoms. There is a need for long-term follow-up studies addressing the potential risk factors for vertigo in neck pain patients, as well as the relationship between MPS and cervicogenic dizziness.

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