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Prevalence of cervicogenic dizziness in patients with neck pain and effectiveness of cervicogenic dizziness rehabilitation

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Abstract

Aim: This study aims to determine the frequency of cervicogenic dizziness in patients suffering from neck pain and observe the efficacy of cervicogenic dizziness (CGD) rehabilitation.

Materials and Methods: It was a retrospective study. The patients aged between 18 and 65 who attended the physical medicine and rehabilitation outpatient clinic and suffered from neck pain were included in the study. Pregnant patients with a history of cervical surgery, missing data, or attending the rehabilitation program irregularly were excluded. Demographic data, treatment protocols, laboratory and radiology results, and Dizziness Handicap Inventory Scores in the 1st and 3rd month after rehabilitation were obtained from the health database. The frequency and reasons for cervicogenic dizziness and the efficacy of the rehabilitation program were observed. $P<0.05$ was considered statistically significant.

Results: Totally, 443 patients were analyzed. 288 patients were female, and 155 were male. The mean age was 50.31 ± 14.06. Cervical disc herniation was determined in 40% (n = 178) of the patients, cervical spondylosis was observed in 11.5% (n = 51) of patients, 45.5% (n = 202) of patients had myofascial pain syndrome and 1.5% (n = 6) of patients defined trauma. Neck pain was associated with dizziness in 8.57% (n = 38). Cervicogenic dizziness was determined in 8.1% of the patients, and the most common reasons were myofascial trigger points and cervical disc hernia. Patients who accepted the cervicogenic rehabilitation program had a better Dizziness Handicap Inventory Score in the 1st and 3 rd month controls.

Conclusion: Cervicogenic dizziness was determined in 8.1% of patients suffering from neck pain. It was detected that the most common reason was cervical pathologies, and the patients benefited from rehabilitation program.

Introduction

The cervical region is a dynamic region with many vital organs and important roles such as balance, body coordination, and regulation of the cardiovascular system. It is open to trauma. Due to its tendency to degeneration, complaints such as neck pain, limitation of movement, dizziness, vertigo, hearing loss, tinnitus, and visual disturbances may be observed. The most consistent diagnostic criteria for the diagnosis were based on the coexistence of neck pain and dizziness after excluding other possible causes of dizziness [1]. Suboccipital muscles are stabilizers in the head and neck. Structural and functional alterations of the suboccipital muscles can cause dizziness, and trigger point activation induced by abnormal head posture may be associated with cervicogenic dizziness [2].

Cervicogenic dizziness (CGD) is defined as the lack of coordination in neck muscle, joint, and bone structures and disruptions in cervical proprioception, causing cervical sympathetic irritation and compressions on the vertebral artery that cause dizziness. Controversy still exists regarding the diagnosis and treatment of CGD [3]. Neck pain in CGD patients is associated with certain dizziness characteristics, increased dizziness severity, and increased physical impairment compared with dizziness patients without neck pain [4].

In fact, the basic hypothesis is that abnormalities in the neck cause dizziness. There is no real vertigo to speak of. The difficulty in making the diagnosis is that there is no specific diagnostic method, and no pathognomic clinical

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elements. The clinicians diagnose CGD by excluding other alternatives [5]. This requires a clinical decision-making process [6] and an algorithm [7].

Various disciplines evaluate the patients suffering from neck pain and accompanying vertigo. These patients are frequently evaluated by neurotology clinics in terms of central and peripheral vestibular pathologies, but the etiology may still not be detected in a group of patients [8].

CGD has defined four main subpopulations of patients: chronic cervicalgia, traumatic, degenerative cervical disease, and occupational. Central causes, benign paroxysmal positional vertigo and otologic pathologies should be excluded in the differential diagnosis. Assessment should include the Dizziness Handicap Inventory, Visual Analog Scale for neck pain, cervical range of motion and posturography [9].

Thus, with this study, we aimed to evaluate the patients who applied to the physical therapy and rehabilitation clinic with complaints of headache and dizziness and to determine the response of these patients to physical therapy.

Materials and Methods

It was designed as a retrospective study. The study was approved by Baskent University Clinical Research Ethics Committee (Date: 03 January 2023, Project no: KA22/515) and carried out in accordance with the declaration of Helsinki. The study was conducted between October 2020 and September 2021. Male and female patients between the ages 18 and 80 who attended our Physical Therapy and Rehabilitation Department with complaints of neck pain were enrolled in the study. Pregnant patients and patients who have a history of surgery in the cervical region, missing documentation, and have not attended the rehabilitation program regularly were excluded.

Considering the statistical techniques planned to be used in data analysis and the number of people required for each variable level to show a normal distribution, a minimum of 377 was found with a margin of error of 0.05 and a confidence interval of 0.95. Minimum 414 patients were calculated considering situations such as missing data and extreme values.

The patient's data were obtained from electronic health records. Demographic data, history of admission, character and duration of complaints, additional symptoms, laboratory and imaging results (such as cervical vertebral magnetic rezonans imaging, carotis doppler ultrasound, vertebral artery doppler ultrasound that may define pathologies like disc hernia, tumor, vertebral artery insufficiency and carotis artery stenosis) otolaryngological and/or neurological records, the treatment protocols, and patients who accepted the cervicogenic rehabilitation program and attended to the therapy regularly were noted. Additionally, the Dizziness Handicap Inventory (DHI) scores of the patients who were included in the cervigenic rehabilitation program (before the therapy, in 1st month and 3rd month control) were noted.

The CGD rehabilitation program applied to the patients included 15 sessions (for three weeks on weekdays) of transcutaneus electrical nerve stimulation (TENS), hotpack, and ultrasound applications, as well as manual therapy, visual ocular reflex (VOR) exercises, stenoclaidomastoid, trapezius, scalene, pectoralis minor muscle, stretching exercises. TENS (BTL-Italy) was used in conventional mode, with 4 pieces of a 5 × 5 cm-diameter adhesive electrode to the cervical paravertebral region, with an 80 herz (Hz) frequency and 180 ms current for 30 minutes. A hotpack (Chattanooga, 15*50 cm) was applied to neck muscles for 20 minutes. Ultrasound (Cosmogammmixing 2-combined therapy) was performed with 1 megahertz (MHz) and 1.5 W/cm^2 dose with ultrasound gel to the right and left cervical paravertebral regions for 5 minutes, totally 10 minutes. Manual therapy methods were performed according to the patient's requirements including manipulations and postizometric relaxation techniques. The visual ocular reflex (VOR) exercises, stenoclaidomastoid, trapezius, scalene, pectoralis minor muscle, and stretching exercises were performed daily during the weekdays for 20 repetitions. All applications and exercises were checked from the health database, and the patients who had all of the therapies from the same physiotherapist were included in the study.

Statistical analysis

Statistical analysis was performed with the SPSS 25.00 program (IBM Corp., Chicago, Illinois, USA). The data was tested with the Shapiro-Wilk test to see if the values were distributed normally or not. Values with normal distribution were defined as mean ± SD, and categorical variables were defined as frequency and percentage. Relationship of etiologies (cervical disc hernia, cervical spondylosis, myofascial syndrome, trauma, cervicogenic dizziness) with age (>65 years, <65 years), gender and pain pattern (acute-chronic) and relationship of the presence of dizziness with etiologies of dizziness (cervical disc hernia, cervical spondylosis, myofascial syndrome, vertebral artery insufficiency, carotis artery stenosis, neurologic and otorhinolaryngological causes) were determined with Pearson Chi-square test and Fisher's Exact test. It was determined that DHI values were not distributing normally. Therefore, the Friedman test was used to compare the DHI scores of the patients taken to a cervicogenic rehabilitation program before therapy, in the 1st month and 3rd month control. Findings were interpreted at a significance level of 0.05 at, a 95% confidence interval.

Results

Four hundreds and forty-three patients were included in the study and analyzed. The mean age was 50.31 ± 14.06, 288 patients were female and 155 were male. Cervical disc herniation was detected in 40% (n = 178), cervical spondylosis in 11.5% (n = 51), myofascial pain syndrome in 45.5% (n = 202), tumor in 1.5% (n = 6) and trauma in 1.5% (n = 6) of the patients (Table 1). No difference was found between the distribution frequency of pathologies in acute and chronic cases (p>0.05). There was no no difference between genders in terms of co-associating pathologies (p>0.05).

Neck pain was associated with dizziness in 8.57% (n = 38), headache in 4.5% (n = 20), shoulder pain in 20.5% (n=91), rheumatological disease in 2.2% (n = 10), Herpes zoster (shingles) in 0.2% (n = 1) of the cases.

Table 1. Comparison of etiologies according to age, gender and pain pattern in patients with neck pain.

Total n=443	Female n=288	Male n=155	P value	Acute Pain n=217	Chronic Pain n=226	P value	<65 years n=375	>65 Years n=68	P value
Age (year) (mean±SD)	51.02±12.67	49.01±13.56	X^2=59.496 0.453#						
Cervical disc hernia	164 (56.9)	76 (49)	X^2=2.541 0.111#	104 (47.9)	136 (60.2)	X^2=6.692 0.010#	21 (56)	30 (44)	X^2=3.274 0.070#
Cervical spondylosis	36 (12.5)	15 (9.7)	X^2=0.788 0.375#	19 (8.8)	32 (14.2)	X^2=3.173 0.75#	12 (3.2)	39(54.7)	X^2=165.704 **0.001***
Myofascial pain syndrom	263 (91.3)	140 (90.3)	$X^2$0.122 0.727#	196 (90.3)	207 (91.6)	X^2=0.217 0.641#	338 (90.1)	65(95.6)	X^2=2.085 0.149#
Trauma	4 (1.4)	2 (1.3)	X^2=0.07 1.000 μ	1 (0.5)	5 (2.2)	X^2=2.542 0.216 μ	5 (1.3)	1 (1.5)	X^2=0.008 0.028#
Cervicogenic dizziness	24 (8.3)	14 (9)	X^2=0.63 0.920#	11(5.1)	27(11.9)	X^2=6.678 0.10#	32 (8.5)	6 (8.8)	X^2=0.006 0.937#

#Pearson Chi-square test, μ Fisher's Exact test * p<0.05 statistically significant. Statistical evaluation was made by adding secondary diseases.

Table 2. Comparison of the presence of dizziness according to diseases.

	Dizziness		
	Present (n=38)	Absent (n=405)	P value
Age (year) (mean±SD)#	52.27±11.99	50.14±14.06	X^2=59.496 0.457
Cervical disc hernia#	21 (55.2)	219 (54.1)	X^2=0.020 0.888
Cervical spondylosisμ	4 (10.5)	47 (11.6)	X^2=0.040 1.000
Myofascial pain syndromμ	36 (94.7)	367 (90.6)	X^2=0.718 0.559
Vertebrobasillary insufficiency#	5 (13.2)	0 (0)	X^2=53.776 **0.001***
Carotid artery partial oclusion#	3 (7.9)	0 (0)	X^2=32.192 **0.001***
Migraineμ	3 (7.9)	17 (4.2)	X^2=1.102 0.241
Neurological causes#	0 (0)	2 (1.8)	X^2=0.189 0.664
Otorhinolaryngological causesμ	0 (0)	1 (0.2)	X^2=0.94 1.000

Pearson Chi-square test, μ Fisher's Exact test * p<0.05 statistically significant.

When patients with and without complaints of dizziness were compared in terms of age factor, no significant difference was detected ($X^2 = 59.496$, p = 0.457). There was no significant difference in the frequency of dizziness between patients with cervical disc herniation ($X^2 = 0.020$, p = 0.888), cervical spondylosis ($X^2 = 0.040$, p = 1.000) and myofascial pain syndrome ($X^2 = 0.718$, p = 0.559) compared to patients without it, but 94.7% of the patients with dizziness were found to have myofascial pain syndrome. The incidence of vertebrobasilar artery insufficiency ($X^2 = 53.76$, p = 0.001) and internal carotid artery stenosis ($X^2 = 32.192$, p = 0.001) is statistically higher in patients with complaints of dizziness than in those without. There was no statistically significant difference between those with and without complaints of dizziness in terms of the detection of migraine ($X^2 = 1.102$, p = 0.241), neurological disease ($X^2 = 0.189$, p = 0.664) or otorhinolaryngological ($X^2 = 0.94$, p = 1.000) (Table 2).

When the average dizziness handicap scores of the patients before and after treatment, at the 1st and 3rd months were compared, a statistically significant improvement was detected ($X^2 = 53.32$, p = 0.001). When posthoc tests were performed with Bonferroni correction, there was a significant improvement before and after treatment (M = 3.96) (p = 0.002), there was a significant difference between pre-treatment and 1st month control (M =2.59) (p = 0.001), 1st month and It was determined that there was no statistically significant difference between the 3rd month controls (M = 1.87) (p = 1.000), but the improvement continued at the 3rd month control compared to the pre-treatment (M

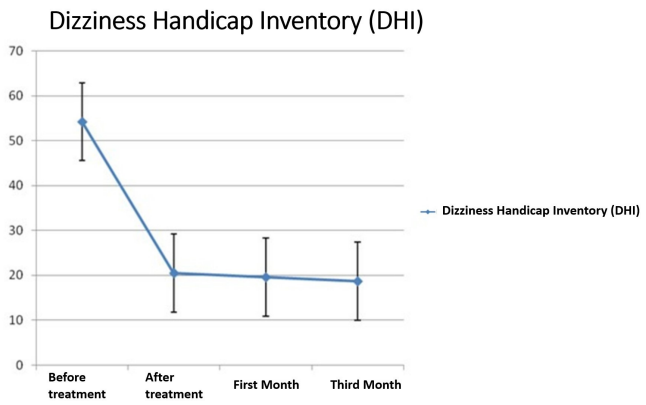

Figure 1. Dizziness Handicap Inventory results prior and after the rehabilitation program.

= 1.59) (p = 0.001). Figure 1 shows the patients' handicap scores after physical therapy.

Discussion

In our study, dizziness or imbalance was found in 8.57% of cases and 71% of these cases were related to cervical pathologies. The association of cervical pathologies and vertigo or dizziness was first reported by Ryan and Cope and named cervical vertigo [10]. The development of vertigo with limitation of neck movements and pain has been associated with vascular insufficiency, sympathetic system activation, and dysfunction of proprioceptive mechanisms. However, it was later argued by Brandt and Bronstein that altered cervical somatosensory associated with neck pain plays the major role in the development of CGD [11]. In addition, it has been reported that CGD was exacerbated by neck movements and neck pain and regressed with improvement of neck pain. In the same study, cervical dizziness was defined as the feeling of imbalance and lightheadiness caused by abnormal afferent activity of the cervical structures [12]. In the study of Knapstad et al., increased incidences of dizziness, drowsiness, visual disturbances, and anxiety, a decrease in cervical joint range of motion and neck-shoulder flexibility were observed in groups of patients with significant neck pain lasting more than 2 weeks. They also noted that in the group of patients with dizziness and neck pain, the severity of dizziness, headache, and cervical tension were significantly increased [13].

In a prevalence study similar to ours, dizziness was seen in 40% of patients. The most common cause of neck pain was myofascial pain syndrome (58.4%). In our study, the most common cause was myofascial pain syndrome (MPS), with 45.5%. The authors also emphasized that biopsychosocial factors are effective in the severity of dizziness and that dizziness due to MPS is associated with good clinical status [14].

When the Dizziness Handicap Inventory (DHI) of 30 patients who accepted the cervicogenic dizziness rehabilitation program and attended regular treatment was compared before (mean 54.26 ± 24.40) and after treatment (mean 20.52 ± 16.58), 1st month (mean 19.60 ± 16.37) and 3rd month (mean 18.69 ± 16.00), a statistically significant improvement was found after treatment ($p<0.001$).

Miracelli et al. compared 93 cervicogenic dizziness patients and 98 age- and sex-matched healthy subjects. In these patients, multiple correlations were found between the posturography test and cervical range of motion and the Dizziness Handicap Inventory, as well as between different self-report and performance measures. Posturography is an advantageous tool in terms of cost, time consumption, and correlation with other measures after excluding other diseases [15]. In a randomized, controlled single-blind study to evaluate how self-report and posturographic measures may be affected in patients with cervicogenic dizziness undergoing continuous natural apophyseal shift, significant improvement in perceived dizziness scores as well as cervical range of motion and some posturographic parameters was achieved in treated patients compared with placebo [16]. Posturography power spectrum analysis is effective in differentiating between patients with cervicogenic dizziness and unilateral vestibular hypofunction. The DHI scale represents their symptoms subjectively [17].

There are many methods being investigated to strengthen the diagnosis. The combined use of the Neck Bournemouth Questionnaire (NBQ) and Tandem Gait scores has been reported to have the highest discriminative ability to detect CGD in patients with chronic dizziness [18]. The use of various questionnaires [19] or a short assessment tool consisting of three questions seems to be useful [20]. The common pattern of cervical dizziness includes restriction and pain during neck flexion, despite normal muscle strength. Decreased joint mobility and pain are also observed, especially at C3, C4 and C5 levels [21]. An 11-year-old girl complained of neck pain and dizziness for four months. Her complaints were probably related to prolonged smartphone use for texting. Static neck flexion can lead to typical injury patterns seen in this age group, even aggravating problems such as cervicogenic dizziness [22].

In our study, the cervicogenic dizziness rehabilitation program contains hotpack, ultrasound manual therapy, visual ocular reflex (VOR) exercises, stenoclaidomastoid, trapezius, scalene, pectoralis minor muscle, stretching exercises. Other studies have also reported that manual therapy is effective for managing dizziness [23, 24]. In addition, considering that cervicogenic dizziness is an increase in abnormal afferent activity coming from the neck, it has been emphasized that radiofrequency ablation of these nerves can be an effective treatment in the diagnosis and treatment of upper cervical medial branch block [25]. Subcutaneous stretching exercise affected the adjacent vertebral artery and increased blood volume, making it effective in CD. Similarly, blade needle therapy also has a good clinical service by increasing brain blood perfusion [26]. The symptoms have been reported to decrease with chiropractic adjustments and ultrasound treatments. Appropriate treatments for neck pain should not be withheld from patients so that CGD is taken into consideration [27].

It is necessary to use radiological clues in the diagnosis of CGD. A 40-year-old patient who had neck pain, dizziness, and auditory symptoms within 12 months had previously received treatment for Meniere's disease for 4 months, but the symptoms did not ease. Radiological evaluation revealed separation of the clivoaxial angle and occipital anterolisthesis. In the case of sequelae after 3 months of treatment, the authors suggested using the clivoaxial angle in the evaluation of craniocervical instability [28]. Additionally, it was reported in radiology that the frequency of vertebral loops increased in patients with cervicogenic dizziness [29].

The most important pathogenesis in the clinic is trauma, muscle spasms, or degenerative diseases, as in our study results. Cervical torsion testing appears to be the best diagnostic method for cervicogenic dizziness [30].

A 49-year-old female patient who presented with acute onset of vertigo and imbalance following self-manipulation of the cervical spine had symptoms resolved at the 1-month follow-up as a result of chiropractic treatments including spinal manipulation, soft tissue release, and rehabilitation exercises and was asymptomatic at the 6-month follow-up [31]. In our study, a significant improvement was observed

in the patients after the first month of treatment. Additionally, one study recommended self-exercise in patients with non-traumatic cervicogenic dizziness to reduce the impact of symptoms on daily life [32].

Conclusion

In our study, the most common cause of cervicogenic dizziness in our patient population was myofascial pain syndrome, and its frequency was found to be 8.1%. The most common causes detected in the patients were cervical reasons, and a significant response was obtained after the rehabilitation program.

Conflict of interest statement

The authors have no conflicts of interest to declare.

Financial disclosure

The authors declared that this study has received no financial support.

Informed consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Ethical approval

The study was initiated with the approval of the Baskent University Medical Faculty Clinical Researches Ethics Committee (Date: 03.01.2023 , Project No: KA22/515).

Author contributions

All of the authors declare that they have all participated in the design,execution, and analysis of the paper, and that they have approved the final version.

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