

Evaluation of COVID-19 Patients Complaining of Balance Disorders with the Dizziness Handicap Inventory

Denge Bozukluğu Bulunan COVID-19 Hastalarının Baş Dönmesi Engellilik Envanteri ile Değerlendirilmesi

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Geliş Tarihi / Received : 23.05.2021

Kabul Tarihi / Accepte: 22.08.2021

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(Sakarya Tıp Dergisi / Sakarya Med J 2021, 11(3):500-506) DOI: 10.31832/smj.941460

This study was presented as an oral presentation at the Turkish National Otorhinolaryngology and Head and Neck Surgery Virtual Congress, 26th-28th of November, 2020.)

Öz

Objective	Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2), the Coronavirus Disease 2019 (COVID-19) agent, affects many systems in the body due to its rapidly developing nature and creates new findings every day. Loss of balance has recently begun to be identified as a clinical manifestation of COVID-19. In this study, the effects on the quality of life and the relationship between the degree of the disease were investigated by applying the "Dizziness Handicap Inventory" to patients who had COVID-19 and experienced balance problems during the active phase of the disease.
Materials and Methods	COVID-19 patients who were hospitalized and followed up between April 2020 and July 2020 were identified by digitally scanning from the hospital registry system, and 300 patients who met the inclusion criteria were sent a "Google survey" link and asked to participate in the survey. Patients who returned to the questionnaire and answered all questions were included in the study and the data obtained were evaluated statistically.
Results	Sixty four patients who answered all questions in the questionnaire were included in the study. Patients between the ages of 35-44 and 45-54 most frequently participated in the study. The mean for total inventory score was 35.90 ± 24.30 (min. 4-max. 88) in all patients. The inventory score means were higher in patients who were hospitalized and those with significant pathology on CT, and a statistically significant difference was also found ($p < 0.05$).
Conclusion	It should be kept in mind patients with COVID-19 may show disequilibrium symptoms and necessary precautions like prevention of falls in the elderly and additions of symptomatic treatment for dizziness should be considered.
Keywords	COVID-19; dizziness; vertigo; Dizziness Handicap Inventory

Abstract

Amaç	Koronavirüs Hastalığı 2019 (COVID-19) ajanı olan Şiddetli Akut Solunum Sendromu-Koronavirüs-2 (SARS-CoV-2), hızla gelişen yapısı nedeniyle vücuttaki birçok sistemi etkilemekte ve her geçen gün yeni bulgular oluşturmaktadır. Denge kaybı, son zamanlarda COVID-19'un klinik bir belirtisi olarak tanımlanmaya başlandı. Bu çalışmada, COVID-19 olan ve hastalığın aktif döneminde denge sorunları yaşayan hastalara "Baş Dönmesi Engellilik Envanteri" uygulanarak yaşam kalitesi üzerine etkileri ve hastalığın derecesi arasındaki ilişki araştırılmıştır.
Gereç ve Yöntem	Nisan 2020-Temmuz 2020 tarihleri arasında hastaneye yatırılarak takip edilmiş COVID-19 hastaları hastane kayıt sisteminden dijital olarak taranarak tespit edildi ve çalışmaya dahil edilme kriterlerine uygun 300 hastaya "Google anket" bağlantısı gönderilerek anket katılmaları istendi. Anket geri dönen ve tüm soruları cevaplayan hastalar çalışmaya dahil edildi ve elde edilen veriler istatistiksel olarak değerlendirildi.
Bulgular	Anketteki tüm soruları yanıtlayan 64 hasta çalışmaya dahil edildi. Çalışmaya dahil edilen hastaların çoğunluğunu 35-44 ve 45-54 yaş gruplarındaki hastalar oluşturdu. Toplam envanter puanı ortalaması tüm hastalarda 35.90 ± 24.30 (min. 4-maks. 88) idi. Envanter skor ortalamaları, hastaneye yatırılan ve BT'de anlamlı patoloji olanlarda daha yüksekti ve istatistiksel olarak anlamlı fark bulundu ($p < 0.05$).
Sonuç	COVID-19 hastalarının denge bozuklukları gösterebileceği akıld tutulmalı ve yaşlılarda düşmelerin önlenmesi ve baş dönmesi için semptomatik tedavi eklenmesi gibi gerekli önlemler alınmalıdır.
Anahtar Kelimeler	COVID-19; dizziness; baş dönmesi; Baş Dönmesi Engellilik Envanteri

INTRODUCTION

A novel coronavirus (severe acute respiratory syndrome-coronavirus-2: SARS-CoV-2) arose from the city of Wuhan, Hubei Province, China in December 2019 and has rapidly expanded into other countries due to its highly contagious transmission from human-to-human.¹ In March 2020, the World Health Organization (WHO) named this recent viral infection as Corona Virus Disease 2019 (COVID-19) and declared it as a pandemic.² Indeed it is responsible for >1,530,000 deaths worldwide.³

The most common findings of this disease since the beginning of the pandemic are fever, cough and fatigue. In addition, headache, dyspnea and diarrhea are the other detected symptoms.⁴ But in severe cases, pneumonia, acute respiratory distress syndrome and multi-organ failure may also develop.⁵ Although the most important symptoms of COVID-19 are respiratory-related, neurotropic and neuroinvasive features of coronavirus have been reported.⁶ COVID-19 can show a great diversity in the type and severity of neurological manifestations. The first reported mild neurological symptoms that emerged quickly after the outbreak were headache and dizziness among central nervous system (CNS) symptoms, and hyposmia, hypogeusia, diplopia, ophthalmoplegia and muscle pain among peripheral nervous system manifestations.⁷⁻¹⁴

Unlike other known upper respiratory infectious agents, COVID has neurotrophic properties and it is thought that different complaints may occur with the effects of active cytokines. In terms of otolaryngological findings, the most focused point has been smell and taste disorders. However, with the increasing number of publications, it is seen that the virus may show different symptoms in terms of otolaryngology. Another finding that occurs with the neurotrophic effects of the virus is balance problems and/or vertigo.¹⁵ Mao et al. reported the rate of patients having dizziness in their study as 16.8% and Korkmaz et al. reported 31%.^{16,17} As it is known, loss of balance can have negative effects on people's daily life. For this reason, it is important to evalu-

ate the effects of balance complaints that may develop due to COVID 19 with objective tests in terms of additional treatment possibilities. However, so far, no study has been conducted to evaluate the symptoms of patients suffering from imbalance that may be associated with COVID-19.

For this purpose, in our study, the impact of disequilibrium findings was investigated by applying the "Dizziness Handicap Inventory (DHI)" to patients who had COVID-19 and had balance problems during the active phase of the disease. Questioning the balance problems that patients experience due to COVID 19 will provide us more information, as well as drawing attention to other neuro-otological effects of COVID-19 and developing treatment options.

MATERIALS and METHODS

Our study was a cross-sectional descriptive study and initiated after permission from the Sakarya University Faculty of Medicine Ethics Committee (No: 10.07.2020 / 401). COVID-19 patients who were hospitalized and followed up between April 2020 and July 2020 were digitally scanned from the hospital registry system and those included were:

- Patients between the ages of 18-65
- Patients whose with positive nasopharyngeal swab for SARS-CoV-2 Reverse Transcriptase-Polymerase Chain Reaction test (RT-PCR) (first positive swab > 30 days- < 60 days before questionnaire administration)
- Have had an outpatient follow up period or hospitalized for COVID 19 infection
- Patients who had no known:
 - History of hearing loss or ear surgery
 - Balance disorder or history of vestibular system disease
 - Serious neurological deficit or a history of nervous system disease
 - Drug use affecting the central nervous system or vestibular system

The identified patients were contacted by phone and questioned whether they experienced a balance problem during the illness. After determining the patients who meet the study criteria, general information as age and gender of the patients in addition to clinical data (fever, myalgia, dyspnea), laboratory tests, and thorax computed tomography (CT) results were recorded. The clinical severity was evaluated based on laboratory, radiologic and clinical data. Whether there was any evidence of lung involvement in the thorax CT, the level of the disease was determined. The way of hospitalization or outpatient treatment were recorded. They were asked to participate in a survey through a "Google survey" link that could be reached online and that was sent via a short message service (SMS) so they could answer questions concerning the findings they experienced during the illness period. The survey contained questions of the DHI questionnaire. The study was carried out in accordance with the Declaration of Helsinki Principles and informed consent was obtained from all participating patients.

DHI is a 25-item questionnaire method developed by Jacobson and Newman in 1990 that determines the factors aggravating dizziness and balance disorders as well as sensory and functional outcomes in vestibular system diseases. 18 Sub-inventories are aimed at determining the physical, sensory and functional effects of vestibular system diseases. Questions 1, 4, 8, 11, 13, 17 and 25 for physical disability; questions 2, 9, 10, 15, 18, 20, 21, 22 and 23 for emotional disability and questions 3, 5, 6, 7, 12, 14, 16, 19 and 24 are structured for measuring functional disability. Each question consists of yes (4 points), no (0 points) and sometimes (2 points) answers. In scoring the sub-units of the inventory, 28 points were recommended as the limit to determine physical disability and 36 points for functional and sensory disability. High scores are interpreted as the patient's complaint of dizziness preventing his life from being at an advanced level. In our study, we applied the Turkish version of this inventory to our patients. Reliability and validity for the Turkish version of DHI were studied

by Canbal et al and it was reported that the Turkish version had satisfactory validity and reliability coefficients¹⁹

The patients are categorized in terms of age range (18-24, 25-34, 35-44, 45-54, 55-65), severity of disease as mild (1) or moderate (2) according to thorax CT results and laboratory test results taken while diagnosing the disease (compatible with COVID-19 or not) and questions about hospitalization or outpatient treatment and obtained score averages are compared according to these parameters.

Statistical analysis

Statistical analyses were done using the SPSS v22.0 program. Since it was determined that the data obtained in the Kolmogorov Smirnov test were distributed significantly differently, non-parametric tests were used to evaluate the data. Independent samples were analyzed with the Mann-Whitney U test, while the Kruskal Wallis test was used for analysis of differences between groups. The minimum, maximum and median values were given and $p < 0.05$ was considered significant.

RESULT

Hospital registry system records of 300 patients who were hospitalized and followed up between April 2020 and July 2020 were scanned and from them who met the inclusion criteria and experienced balance complaints during the process of the disease were included in our study. When the survey results were examined, it was found that 72 patients participated in the survey. Questionnaire results of 8 patients were not completed and were excluded from the study. Therefore, 64 patients (28 female, 36 male) who answered all questions were included in the study.

Eight patients (12%) between the ages of 18-24, 14 patients (22%) between 25-34, 17 patients (27%) between 35-44, 16 patients (25%) between 45-54 and 9 patients (14%) between 55-65 participated in the study (Figure 1). Of the 64 patients who fully answered the questionnaire and were included in the study, 31 of them were hospitalized and 33

were followed up on an outpatient basis. According to the laboratory and lung involvement levels of the patients, 30 of them were in moderate group and 34 of them were in mild group in terms of disease severity.

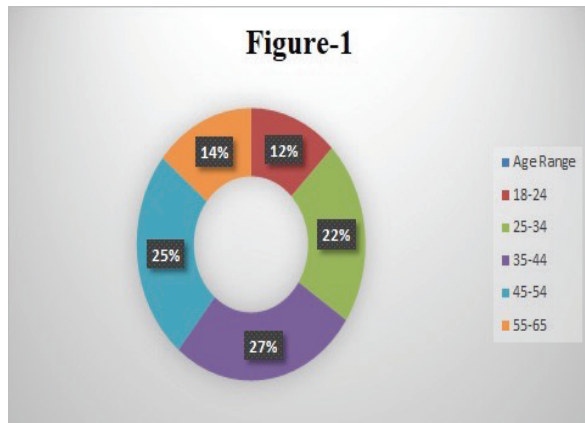


Figure 1: Age ranges of patients included in the study

The mean for total inventory score was 35.90 ± 24.30 (min. 4-max. 88; median 27) for all patients. From the sub-inventories, the mean score for physical disability was 11.80 ± 6.80 (min. 0-max. 24; median 10), for emotional disability was 10.90 ± 8.80 (min. 0-max. 32; median 8) and for functional disability was 13.10 ± 10.10 (min. 0-max. 36; median 8) (Table-1). In the inventory subgroups, the highest mean score was obtained for the 25th question (2.12 ± 1.60) in the physical disability subgroup, and the lowest mean score was obtained for the 15th question in the emotional disability subgroup (0.91 ± 1.42).

	n	Median	Min.	Max.
Physical Disability Scores	64	10	0	24
Emotional Disability Scores	64	8	0	32
Functional Disability Score	64	8	0	36
Total Inventory Score	64	27	4	88

n: Number; Min.=Minimum; Max.=Maximum

When the relationship between severity of disease and inventory scores was evaluated, a statistically significant difference was found between the total and sub-inventory

(physical, emotional, functional) scores between those who were in moderate and mild groups ($p < 0.001$, $p = 0.01$, $p < 0.01$, $p < 0.01$, respectively) (Table-2). When the scores of the patients were evaluated in terms of treatment type (hospitalization/outpatient), a significant difference was found in physical and functional scores ($p = 0.019$, $p = 0.034$, respectively), while no statistically significant difference was found in emotional and total scores ($p > 0.05$, $p = 0.06$, respectively) (Table-3). When the relationship between age range and inventory scores was analyzed, no statistically significant difference was found between the groups ($p > 0.05$) (Table-4) (Figure 2).

		Physical Disability Scores	Emotional Disability Scores	Functional Disability Score	Total Inventory Score
Moderate	n	30	30	30	30
	Median	16	14	17	51
	Min.	0	0	2	4
	Max.	24	28	36	88
Mild	n	34	34	34	34
	Median	8	6	6	20
	Min.	2	0	0	6
	Max.	22	32	32	86
	p*	<0.001	0.01	0.008	0.002

n=Number; Min.=Minimum; Max.=Maximum; *=Mann-Whitney U test

		Physical Disability Scores	Emotional Disability Scores	Functional Disability Score	Total Inventory Score
Hospitalization	n	33	33	33	33
	Median	10	6	6	22
	Min.	2	0	0	6
	Max.	22	32	32	86
Outpatient	n	31	31	31	31
	Median	16	12	18	52
	Min.	0	0	2	4
	Max.	24	28	36	88
	p*	0.019	0.202	0.034	0.06

n=Number; Min.=Minimum; Max.=Maximum; *=Mann-Whitney U test

Table-4: The relationship between age range and inventory scores

Age Range		Physical Disability Scores	Emotional Disability Scores	Functional Disability Score	Total Inventory Score
18-24 (n=8)	Median	9	4	6	18
	Min.	2	0	2	8
	Max.	22	28	32	76
25-34 (n=14)	Median	14	12	20	52
	Min.	4	0	2	8
	Max.	24	28	36	88
35-44 (n=17)	Median	10	8	6	22
	Min.	2	2	0	6
	Max.	24	32	32	86
45-54 (n=16)	Median	9	6	10	27
	Min.	0	0	4	4
	Max.	20	20	24	58
55-65 (n=9)	Median	18	16	18	58
	Min.	4	0	4	8
		24	28	36	84
	p*	0.029	0.102	0.275	0.299

n=Number; Min.=Minimum; Max.=Maximum; * Kruskal Wallis test

DISCUSSION

To our knowledge, this is the first study in which DHI was used to evaluate the complaint levels of patients with balance problems during the period of COVID-19 and its effect on quality of life. DHI is one of the most frequently used questionnaires to evaluate the effects of dizziness. When dizziness is seen in other diseases, the characteristic and fluctuation periods can vary significantly. In a holistic approach, objectively measuring how dizziness is perceived by patients in all age groups, particularly in elderly individuals, is important in patient follow-up.²⁰ DHI is frequently used to determine the effects of subjective dizziness on quality of life in patients with peripheral and central vestibular pathology.¹⁸ Therefore, we decided to use this questionnaire in our study.

When the data were examined, the total mean score of the

inventory was 35.90, and it was determined that the balance problem experienced by the patients had no small effect on the quality of life. The highest results were found in physical and functional disability subgroups, and the average score was found to be the lowest in the emotional disability subgroup. When evaluated individually, the question with the highest average score was found in the physical disability subgroup, while the lowest was found in the emotional disability subgroup. Although there was no statistically significant difference between age groups, the inventory score averages were higher in patients who were hospitalized and those in moderate group, and a statistically significant difference was also found. This shows that an increase in the severity of the disease had a greater effect on balance problems and quality of life.

A receptor that is found in many organs, including the nervous system and skeletal muscles, ACE2, was identified as the functional receptor for SARS-CoV-2 in January 2020.²¹ In light of this information, the expression and distribution of ACE2 shows that the virus may cause neurologic findings through direct or indirect mechanisms.¹⁶ In addition to the direct cytopathic effect of the SARS-CoV-2, inflammatory response, cytokine storm and cerebrovascular accidents, particularly in the posterior circulation, may also induce balance problems associated with COVID-19.^{16,22,23} Also, neurologic symptoms were examined in 3 categories: peripheral nervous system (PNS) symptoms such as taste/smell/vision impairment, and nerve pain; central nervous system (CNS) symptoms such as headache, acute cerebrovascular disease, impaired consciousness, ataxia, seizure and dizziness; and skeletal muscular injury symptoms.¹⁶ In addition, drugs used for COVID-19 have a high potential to cause oto-vestibulotoxic side effects. It has been reported that drugs such as hydroxychloroquine and azithromycin, which were more commonly used in the early stages of the pandemic, were prescribed at a rate of up to 12% in Europe, and balance problems may be observed due to the side effects of these drugs.²⁴ The disequilibrium findings that may occur due to these side effects may be confused

with findings of COVID-19.

There are very few studies in the literature examining vestibular symptoms associated with COVID-19, and sufficient information cannot be obtained from these studies. Although in recent studies it has been reported that COVID-19 patients experience more vestibular findings, much less emphasis was placed on the early stages of the pandemic. This was due to the fact that vertigo and dizziness were either not very common symptoms, or perhaps the focus was more on life-threatening symptoms.²⁵ Karadas et al. reported the rate of dizziness as 6.70% in their study in which they evaluated neurological manifestations.²⁶ In the study of Mao et al. in which 214 patients were examined, neurological findings were found in 78 patients; among these, the CNS findings were the highest (53 patients), and the highest rate (16.80%) among the CNS findings was dizziness (36 patients).¹⁶ In the study of Özçelik et al., 116 PCR (+) patients were evaluated and 31.80% of them had dizziness and 6% had true vertigo, and this rate seems to be the highest in the literature up to now.¹⁷ In the study conducted by Viola et al.,¹⁸ 40% of the patients were found to have disequilibrium findings, and 94.10% of them had dizziness and 5.90% had vertigo attacks.²⁷ In this study, the patients were asked whether there was a complaint of imbalance that started with COVID-19, and in the study reported by Özçelik et al.¹⁷, the level of imbalance complaint experienced by the patients was evaluated with VAS. Although it is overlooked in terms of otolaryngological complaints, the complaint of imbalance can be an important complaint in COVID-19. The extent to which the quality of life is affected due to imbalance has not been analyzed in detail in the studies conducted so far. We preferred to use DHI because it is the most commonly used questionnaire about this topic in the literature. Although it was mostly developed for chronic balance disorders; in our study, it was observed that the survey scores of the patients were significantly higher. Considering that the effect of quality of life due to loss of smell and taste has been emphasized so far in terms of otolaryngology, this study highlights

the necessity to consider balance disorders. No additional treatment options are mentioned in the publications yet. However, in future detailed studies, it will become clear whether the situation is due to the involvement of the vestibular system and additional treatment options may come to the fore. Our study can be considered as a preliminary study on this subject and our aim is to draw attention to the possible vestibular system involvement of the SARS-CoV-2 virus. One of the limitations of our study is the lack of objective examination methods. In the future, studies to be carried out with objective tests (e.g. VHIT, VNG) as well as surveys will be more guiding in this regard.

CONCLUSION

In conclusion, it should be kept in mind that patients with COVID-19 may experience balance problems. The effects on quality of life in addition to other symptoms should be taken into account and necessary precautions such as for prevention of falls in the elderly and addition of symptomatic treatment for dizziness should be applied. More studies are needed to focus on balance problems in patients with COVID-19.

Acknowledgment

The authors declare no conflict of interest.

Disclosure statement

The authors received no financial support for the research and/or authorship of this article.

Our study was initiated after permission from the Sakarya University Faculty of Medicine Ethics Committee (No: 10.07.2020 / 401).

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