Evaluation of Sleep Quality, Daytime Sleepiness Levels, and Anxiety and Depression Levels of Inpatients with COVID-19 Treatment According to Oxygen Needs: A Case-control Study

Yatan COVID-19 Tedavisi Olan Hastaların Uyku Kalitesi, Gündüz Uykululuk Düzeyleri ile Anksiyete ve Depresyon Düzeylerinin Oksijen İhtiyaçlarına Göre Değerlendirilmesi: Bir Olgu Kontrol Çalışması

Ⓘ Soner Kılıç, Ⓘ Güven Aslan, Ⓘ Büşra Eser*, Ⓘ Yunus Hacımusalar**

Kayseri City Hospital, Clinic of Neurology, Kayseri, Turkey
**Kayseri City Hospital, Clinic of Psychology, Kayseri, Turkey*
***Kayseri City Hospital, Clinic of Psychiatry, Kayseri, Turkey*

Abstract

Objective: Coronavirus disease-2019 (COVID-19) has detrimental effects on both physical and mental health of patients. Since sleep quality is closely related to the health status of a person, deterioration in sleep is expected in these patients. The aim of this study was to detect sleep problems in 19 consecutive inpatients and compare them with other inpatients with different diagnoses in order to determine whether being a pandemic patient makes a significant difference.

Materials and Methods: Pittsburgh Sleep Quality Index has a value between 0 and 21 points. High values indicate poor sleep quality and a high level of sleep disturbance. If the total score is above 5, it indicates that the sleep quality is clinically poor. The hospital anxiety depression scale is a self-report scale and consists of 14 items, 7 of which investigate depression and 7 anxiety symptoms.

Results: Fifty one inpatients were included in this study as the control group (group 1). Fifty COVID-19 positive patients hospitalized in need of oxygen (group 3) and 50 COVID-19 positive patients hospitalized with no need for oxygen (group 2) were enrolled in the study. The oxygen need of patients was found to be significantly related to the presence of chronic diseases.

Conclusion: Depression rates were found to be significantly higher in COVID-19 patients compared with the control group. Further studies with an increased number of cases are needed to establish a better link between oxygen need and sleep disorders.

Keywords: COVID-19, sleep disorder, insomnia, anxiety, depression

Öz

Amaç: Koronavirüs hastalığı-2019 (COVID-19), hastaların hem fiziksel hem de ruhsal sağlığını olumsuz etkilemektedir. Uyku kalitesi kişinin sağlık durumu ile yakından ilişkili olduğundan bu hastalarda uykuda bozulma beklenir. Bu çalışmanın amacı, yatarak tedavi gören COVID-19 hastalarındaki uyku problemlerini tespit etmek ve farklı tanılara sahip diğer yatan hastalarla karşılaştırmak ve pandemi hastası olmanın anlamlı bir fark yaratıp yaratmadığını anlamaktır.

Gereç ve Yöntem: Sosyo-demografik veri formu, Pittsburgh Uyku Kalitesi İndeksi (PUKİ), hastane anksiyete depresyon ölçeği (HADS) hastanemizde bir psikolog tarafından hastalara yüz yüze uygulandı. PUKİ toplamda 0-21 puan arasında bir değere sahiptir. Yüksek değerler, kötü uyku kalitesini ve yüksek düzeyde uyku bozukluğunu gösterir. Toplam puanın 5'in üzerinde olması uyku kalitesinin klinik olarak kötü olduğunu gösterir. HADS ölçeği bir öz bildirim ölçeğidir ve 7'si depresyon belirtilerini ve 7'si anksiyete belirtilerini araştıran 14 maddeden oluşmaktadır.

Bulgular: Bu çalışmaya 51 yatan hasta kontrol grubu (grup 1) olarak dahil edildi. Hastanede oksijen ihtiyacı olan 50 COVID-19 pozitif hasta (grup 3) ve oksijen ihtiyacı olmadan hastaneye yatırılan COVID-19 pozitif 50 hasta (grup 2) çalışmaya alındı. Hastaların oksijen ihtiyacı, kronik hastalık varlığı ile anlamlı olarak ilişkili bulundu. Oksijen ihtiyacı olan hastalarda anksiyete çok daha baskındı. Ayrıca diğer COVID hastalarına ve farklı tanılı hastalara göre daha fazla uyku bozukluğu ifade ettiler, ancak PUKİ sonuçları açısından aralarında anlamlı bir fark yoktu.

Sonuç: COVID-19 hastalarında depresyon oranları kontrol grubuna göre anlamlı derecede yüksek bulundu. Oksijen ihtiyacı ve uyku bozuklukları arasında daha iyi bir bağlantı kurmak için olgu sayısı artan ileri çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: COVID-19, uyku bozukluğu, uykusuzluk, anksiyete, depresyon

Introduction

Sleep may be defined as a state of rest which is essential for organism to replenish its vitality. In this period, whole body systems clear up the residual effects of their previous activities and prepare themselves for the future tasks. Good sleep is necessary for the proper continuation of daily life activities of human beings. It is not surprising that there are numerous studies about sleep and its effects on human health. It is known that a poor-quality sleep may lead to many health problems (1-3). Learning difficulties and memory deficits may result from sleep deprivation. In a well-documented study hippocampal attenuated intracellular cyclic adenosine monophosphate-protein kinase A signalling and glutamate receptor expression was blamed for these disorders (4). On the other hand, acute or chronic many diseases influence sleeping habits and quality. With aging, a decrease in sleep time and an increase in sleep disorder prevalence are expected. Some neurological diseases like Parkinson's disease and Alzheimer's disease may frequently occur due to insomnia and daytime sleepiness. Caffeine, alcohol, and nicotine intake all have detrimental effects on overall quality of sleep (5).

The novel Coronavirus disease-2019 (COVID-19) pandemic has become a major stressor for the whole world. Although it is a physically transmitted disease in its nature, the anxiety and fear of the outbreak have spread rapidly all around the world. Higher depression rates were found during the pandemic (6-9). It is inevitable effects on psychology of human being has been studied widely. On the other hand, there are relatively a few studies focusing on the sleep quality of the hospitalized patients. In a study conducted in a local hospital, worse sleep characteristics in patients compared to the normal group were noted regardless of their clinical diagnosis (10).

At this point, the study hypothesis is to find poorer quality of sleep and higher rates of anxiety and depression in COVID-19 patients who need oxygen treatment compared to the other COVID-19 patients and patients of other diagnosis.

Materials and Methods

The study was approved by the Kayseri City Hospital Ethic Committee (decision no: 465, date: 26.08.2021), and written informed consent was obtained from all participants.

This study followed the tenets of the Declaration of Helsinki. All participants provided informed consent. Name, surname, age, gender, current diagnosis and medical history of patients were noted. Group 1: This group of patients was enrolled from wards other than surgery and oncology wards. COVID-19 patients were divided into two groups according to their oxygen need. Group 2: COVID-19 patients did not need oxygen treatment. Group 3 was named for the COVID-19 patients needed oxygen treatment.

Pittsburgh Sleep Quality Index (PSQI): PSQI was developed by Buysse et al. (11) and the Turkish validity and reliability was made by Agargün and Kara (12) PSQI is a 19-item self-report scale that evaluates sleep quality and disorder over the past month. It consists of 24 questions in total. Nineteen questions included the person's own statement, 5 questions included the questions answered by the spouse or bed mate. The scored 18 questions of the scale consist of 7 components. These subcomponents consist of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disorder, use of sleeping medication and daytime dysfunction. Each component is evaluated on a score of 0-3. The total score of 7 subcomponents gives the total score of the scale. PSQI has a value between 0-21 points in total. High values indicate poor sleep quality and a high level of sleep disturbance. If the total score is above 5, it indicates that the sleep quality is clinically bad.

Richards Campbell Sleep Questionnaire (RCSQ): RCSQ is a five-item scale measuring the perception of depth of sleep, sleep onset latency, awakenings, time spent awake and sleep quality.

Hospital Anxiety Depression Scale (HADS): HADS was prepared to screen anxiety and depression in people with physical illnesses and was developed by Zigmond and Snaith (13). The Turkish form was developed by Aydemir et al. (14). By adapting it in 1997, its validity-reliability study was carried out. As a result of the receiver operating characteristic analysis, the cut-off points of the Turkish version of the HADS were determined as 10 for the anxiety subscale and 7 for the depression subscale. The scale is a self-report scale and consists of 14 items, 7 of which investigate depression symptoms and 7 anxiety symptoms.

Statistical Analysis

The analysis of the study was done with the SPSS 22.0 statistical software. Histogram, Skewness and Kurtosis values were used as well as the Kolmogorov-Smirnov test for the distribution of normality. Gender, the presence of chronic disease, sleep disorder, poor sleep quality, presence of anxiety and depression, smoking rates are the qualitative data. Age, time spent in bed, sleep duration, percentage of sleep are quantitative data.

Chi-square was applied for the comparison of the categorical groups. Corelation methods were used to model relationships between variables. Pearson correlation analysis was applied for the correlation of values with normal distribution, and Spearman correlation analysis was performed for those not showing normal distribution.

Independent samples t-test was used to compare the means of two normally distributed independent groups, and the Mann-Whitney U test was used to compare the medians of two independent groups not showing normal distribution. one-way ANOVA test was used in 3 independent group comparisons of normally distributed data (age, time spent in bed, sleep duration, percentage of sleep, PSQI, RCSQ, HADS).

H_0 **hypothesis:** There is no significant difference between the groups in terms of age, time spent in bed, sleep duration, percentage of sleep, PSQI, RCSQ, HADS.

H_1 **hypothesis:** There is a significant difference between groups in terms of age, time spent in bed, sleep duration, percentage of sleep, PSQI, RCSQ, HADS.

As a post-hoc analysis, Tukey was applied to data where variances were homogeneously distributed (age, time in bed, sleep time, PSQI, RCSQ), and Games-Howell test was applied to data where variances were not homogeneously distributed. The Kruskal-Wallis H Test was used for comparisons of three independent groups of scales that did not show normal distribution.

In cases where there was a significant difference between the groups, two groups were compared, and Bonferroni correction was applied to determine which groups the difference was between. Significance level was accepted as 0.05.

Results

Fifty COVID-19 positive patients hospitalized in need of oxygen (group 3) and 50 COVID-19 positive patients hospitalized with no need for oxygen (group 2) were enrolled in the study as two separate groups. In addition, 51 inpatients with diagnosis other than COVID-19 were included in this study as the control group (group 1). The distribution of patients according to gender, the presence of chronic disease, sleep disorder, poor sleep quality, presence of anxiety and depression, smoking rates are shown in Table 1.

The chronic disease rates of COVID-19 patients who received oxygen therapy were found to be significantly higher (p<0.001). While the rate of patients who defined sleep disorder was significantly higher in the group that need oxygen than the other two groups (p=0.005), there was no statistically significant difference in terms of the rates of those with poor sleep quality compared to PSQI (p=0.979).

Anxiety was significantly higher in COVID-19 patients who received oxygen therapy (60%) compared to the other two groups (p=0.003). Regardless of their oxygen need, depression rates were found to be significantly higher in COVID-19 patients compared to the control group (p=0.001). Depression ratio was 38% in this study. The comparison of age, body mass index, sleep time, time spent in bed at night, percentage of sleep, PSQI scores, Richards and HAD levels of the study group are shown in Table 2. In the analysis performed, the mean age of COVID-19 positive patients who needed oxygen therapy was found to be significantly higher than the COVID-19 positive patients who did not need oxygen and the control group (Table 2).

In this study, mean age was 66.1±13.1 in the group that needed oxygen treatment. Group 3's time spent in bed and sleep time were significantly higher than the control group. Also, group 3 had higher HAD levels compared to the control group.

Discussion

There is only a little about sleep quality of COVID-19 inpatients in the field literature. This study raises awareness of sleep disorders in hospitalized COVID-19 patients and serves as a mainstay for healthcare workers who may would like to implement some modalities on sleep. In this study, the chronic disease rates of COVID-19 patients who received oxygen therapy were found to be significantly higher. An article published in Italy shows that patients with COVID-19 who were taken into intensive care unit had a much higher rate (72.2%) of their previous chronic diseases compared to those who are not taken to intensive care (37.3%) (15). Likewise, the patients that have high chronic disease rates in our study needed oxygen therapy which was an indicator of severe disease.

Table 1. Distribution of groups by gender, presence of symptoms of sleep disorder, anxiety, depression and smoking rates								
	Group 1 (n=51) (Mean ± SD)		Group 2 (n=50) (Mean ± SD)		Group 3 (n=50) (Mean ± SD)			
Gender	%	n	%	n	%	n	X^2	p
Female	41.2	21	44.0	22	46.0	23	0.241	0.886
Male	58.8	30	56.0	28	54.0	27	-	-
Chronic disease								
Yes	25.5	13	22.0	11	56.0	28	15.530	<0.001*
Sleep disorder								
Yes	51.0	26	50.0	25	78.0	39	10.518	0.005*
Sleep quality								
Poor	60.8	31	60.0	30	62.0	31	0.043	0.979
Anxiety								
Yes	27.5	14	38.0	19	60.0	30	11.427	0.003*
Depression								
Yes	9.8	5	34.0	17	42.0	21	13.969	0.001*
Smoking								
Yes	21.6	11	8.0	4	12.0	6	6.105	0.191
*p<0.05								
Group 1: Inpatients with non-COVID diagnosis (control group)								
Group 2: Patients who are positive for COVID and do not need oxygen therapy								
Group 3: Patients who are positive for COVID and need oxygen therapy								
SD: Standard deviation, COVID: Coronavirus disease								

Table 2. Comparison of age, BMI, anxiety, depression levels and sleep-related assessments between groups

	Group 1 (n=51) (Mean ± SD)	Group 2 (n=50) (Mean ± SD)	Group 3 (n=50) (Mean ± SD)	Comparison[+]		Post-hoc test (Tukey or Games-Howell) (p-values)		
				F	p	Group 1-2	Group 1-3	Group 2-3
Age[++]	56.2±17.9	54.2±16.3	66.1±13.1[a]	8.113	<0.001	0.804	0.006*	0.001*
BMI[++]	26.1±6.1	28.0±5.1	28.5±5.6	2.645	0.074	-	-	-
Time in bed (minutes)	469.5±97.2	496.8±93.9	544.4±111.2[b]	7.096	0.001	0.366	0.001*	0.051
Sleep time [++] (minutes)	453.3±95.8	475.9±92.7	523.1±116.5	6.116	0.003	0.510	0.002*	0.058
Percentage of sleep (%)[+++]	96.7±2.4	95.7±2.0	95.6±4.1	1.338	0.226	0.174	0.398	0.993
PSQI[++]	6.4±2.3	6.4±2.2	6.7±2.3	0.328	0.721	0.993	0.798	0.734
RCSQ[++]	346.8±105.9	336.0±99.5	323.2±91.5	0.720	0.489	0.846	0.456	0.795
HAD anxiety[++]	5.9±3.6	6.9±4.4	8.1±3.7	3.989	0.021	0.394	0.015*	0.290
HAD depression[+++]	5.8±3.5	8.3±5.1	9.3±4.4	8.702	<0.001	0.015*	<0.001*	0.525
HAD total[+++]	11.6±5.7	15.1±8.9	17.4±7.4[b]	7.644	0.001	0.054	<0.001*	0.368

*p<0.05, [+]Analysis of Covariance (ANOVA), [++]Tukey, [+++]Games-Howell, [a]Significantly higher than group 1 and group 2, [b]Significantly higher than group 1

Group 1: Inpatients with non-COVID diagnosis (control group)

Group 2: Patients who are positive for COVID and do not need oxygen therapy

Group 3: Patients who are positive for COVID and need oxygen therapy

SD: Standard deviation; n: Number of participants, COVID: Coronavirus disease, BMI: Body mass index, HAD: Hospital anxiety depression, PSQI: Pittsburgh Sleep Quality Index, RCSQ: Richards Campbell Sleep Questionnaire

While the rate of patients who defined sleep disorder was significantly higher, there was no statistically significant difference in terms of the rates of those with poor sleep quality compared to PSQI. This situation may be related to the limited number of case studies. In a review and meta-analysis of studies about sleep disorders during the pandemic revealed increased sleep disorders both in general population and COVID-19 patients especially with active disease (16).

Beside a possible intermingled relation to sleep disorders, anxiety is another emerging health concern during the pandemic. In a meta-analysis of 17 studies about anxiety in general population carried out during the pandemic, one third of participants showed anxiety symptoms (17). Another study documented high levels of anxiety both in COVID-19 patients and their relatives (18). In our study, anxiety was significantly higher in COVID-19 patients who received oxygen therapy (60%) compared to the other two groups. In a molecular basis, increased glutamate N-methyl-D-aspartate (NMDA) receptor subunits 2B (GluN2B) and phosphorylated-ERK1/2 in striatumand hippocampus were blamed foranxious behaviour in hypoxic mouse models (19). In addition to altered proper oxygenation, CO_2 retention may be seen in COVID-19 patients. These conditions again elicit anxiety behaviour via stimulating chemosensors located in amygdala (20).

It was found that regardless of their oxygen need, depression rates were significantly higher in COVID-19 patients compared to the control group. In a recent study 32.3% of COVID-19 inpatients diagnosed with depression which confirmed increased prevalence (21). This ratio was 38% in our study. Another study that is composed of COVID patients carried out at the epicentre of the outbreak proved this finding right by confirming more depression cases than usual. In this study, no correlation between disease severity and depression scores

were noted (7). The pandemic's physical and mental burden on sleep performance is worth investigating. A study performed via phone-based questionnaires about sleep performance and anxiety of healthy volunteers showed high incidence of impaired sleep and increased anxiety (8).

A comprehensive meta-analysis of 55 studies found 3.36 times increased risk of severe disease in the patients older than 50 years old (22). In our study, mean age was 66.1±13.1 in the group that needed oxygen treatment.

The most important limitation of this study is the insufficient number of cases and the sleep assessment using self-report scales. In such a study, evaluation of sleep with polysomnography (PSG) would give much more meaningful findings. However, during the pandemic period, due to the fact that the hospital where the study was carried out served as a pandemic hospital, the number of non-COVID-19 patients' admissions were low and the sleep laboratory could not be used effectively, so a sufficient number of PSGs could not be applied.

COVID-19 patients were divided into patients using oxygen and not using oxygen according to their need for oxygen, but a correlation assessment between oxygen therapy applied and sleep quality could not be made because the amount of oxygen needed varies. The drug treatments administered to the patients may affect the quality of sleep, but an analysis of the drugs could not be done because the patients used different treatments and doses that could not be grouped.

Conclusion

COVID-19 is an ongoing emergency situation that needs understanding of every aspect. It's impact on sleep and mental health is worth investigating. Increased anxiety, depression and sleep disorder levels are expected both in patients and general population. Alongside the antiviral treatment psychologic

intervention should not be overlooked if needed. Further studies with increased number of cases are needed to establish a better link between oxygen need and sleep disorders.

Ethics

Ethics Committee Approval: The study was approved by the Kayseri City Hospital Ethic Committee (decision no: 465, date: 26.08.2021).
Informed Consent: Written informed consent was obtained from all participants.
Peer-review: Internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: S.K., Y.H., Concept: S.K., G.A., B.E., Y.H., Design: S.K., G.A., B.E., Y.H., Data Collection or Processing: S.K., B.E., Y.H., Analysis or Interpretation: S.K., B.E., Literature Search: S.K., G.A., B.E., Y.H., Writing: S.K.,
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