Progress in Nutrition 2022; Vol. 24, Supplement 1: e2022059 DOI 10.23751/pn.v24iS1.12883

Original article

Sleep Quality of Patients with COVID-19 after Hospital Discharge

Nevhiz Gündoğdu[1], *Mustafa Tanrıverdi*[2]

[1]Department of Pulmonary Medicine, SANKO University, Gaziantep, Turkey; [2]Department of Infectious Diseases, SANKO University, Gaziantep, Turkey

Abstract. *Study Objectives:* We planned to evaluate the sleep quality of patients with COVID-19 in their first-month follow-up and investigate whether it is related to the severity of the disease and the current symptoms and laboratory findings of the individual. *Methods:* The study was designed as an observational cross-sectional study. COVID-19 diagnosed and hospitalized patients who agreed to participate and came to the outpatient clinic for the 1st-month of inpatient treatment were included in the study. COVID-19 severity was defined as the location of treatment in the hospital: admission place intensive care unit (ICU) was accepted as severe case; the ward was accepted as mild cases. A questionnaire including demographics, comorbidities, current complaints, and the Pittsburg sleep quality test was filled in at the time of admission to the outpatient clinic. All patients were grouped according to PSC as good sleep group (PSC<5) and bad sleep group (PSC>=5). *Results:* In the study period 83 patients (49 male and 34 female) had full-fill criteria and were admitted into the study. Those patients were treated %30.1 in ICU and %69.9 in the ward. The sleep score value for the 1st month ranged from 0 to 20 median of 5. The sleep duration (hour) value ranged from 3 to 11, with an average of 7.2±1.5. 56.6% (n=47) of the patients had poor sleep quality according to the Pittsburg scale. *Conclusions:* The sleep quality of COVID-19 patients was impaired in the 1st-month controls and was not associated with the severity of the COVID-19 disease.

Key words: sleep quality, COVID-19, pittsburg scale

Introduction

The novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), known as Coronavirus disease 2019 (COVID-19), was first identified in December 2019 in the city of Wuhan, located in central China (1). At the time of writing this article, severe acute respiratory coronavirus syndrome-2 (SARS-CoV-2) has infected more than 157,973,438 patients and resulted in more than 3,288,455 deaths worldwide (as of May 2021).1The common symptoms were fever (77.4–98.6%), cough (59.4–81.8%), fatigue (38.1–69.6%), dyspnea (3.2–55.0%), myalgia (11.1–34.8%), sputum production (28.2–56.5%), and headache (6.5–33.9%) sore throat, rhinorrhea, chest pain, hemoptysis, conjunctival congestion, diarrhea, nausea, and vomiting were less common (2). When neurological symptoms are inquired during COVID-19, sleep disturbance is the most common symptom stated (3).

Sleep is very important for both our psychological and physical health and can be affected by many factors. Various publications are showing that poor sleep quality impairs the immune response (4-7). Although there are studies conducted during the disease, there is limited study showing how to sleep quality changes after the disease and whether it changes with the severity of the disease. Therefore, in our study, we planned to evaluate the sleep quality of patients with COVID-19

in their first month follow-up and investigate whether sleep quality is related to the severity of the disease and the current symptoms and laboratory findings of the individual.

Material and Method

The study was conducted at SANKO University between August 2020 and March 2021 on patients who were admitted to the SANKO University COVID outpatient clinic at the 1st-month controls (Patients who applied within 30-40 days after discharge were included in the study) after hospitalization. Patients who agreed to participate in the study were included in the study. Ethics Committee approval was obtained from SANKO University Clinical Research Ethics Committee with the decree dated 5.3.2021, session number 2021/06, no 01. Figure 1 is shown the flow chart of the inclusion and exclusion criteria of the study.

Patients with known sleep problems, patients using sleep devices, patients receiving psychiatric treatment, and pregnant women were excluded from the study. All patients are older than 18 years. COVID-19 severity was defined as the location of treatment in hospital: admission place intensive care unit (ICU) was accepted as severe case; the ward was accepted as -moderate cases. A questionnaire including demographic characteristics, current complaints, and the Pittsburg sleep quality test (PSQI) was filled in at the time of admission to the outpatient clinic. In their admission, complete blood count, C-reactive protein (CRP), urea, creatinine, sodium (Na), potassium (K), Liver enzymes; aspartate aminotransferase (AST), alanine aminotransferase (ALT), D-dimer, Ferritin values were recorded. Also, the hospitalization records of the patients were scanned retrospectively, admission complaints, application laboratory findings, hospitalization time, intensive care unit (ICU) hospitalization period, and treatments used during hospitalization were obtained from these records. All patients were grouped according to ICU and ward hospitalization place. Inpatients were diagnosed and treated in accordance with the guidelines of the Turkish Ministry of Health (8).

The PSQI was used to evaluate sleep quality over the previous month (9). The participants were split into two groups based on their PSQI scores. Patients with PSQI scores <5 were assigned to the good-sleep

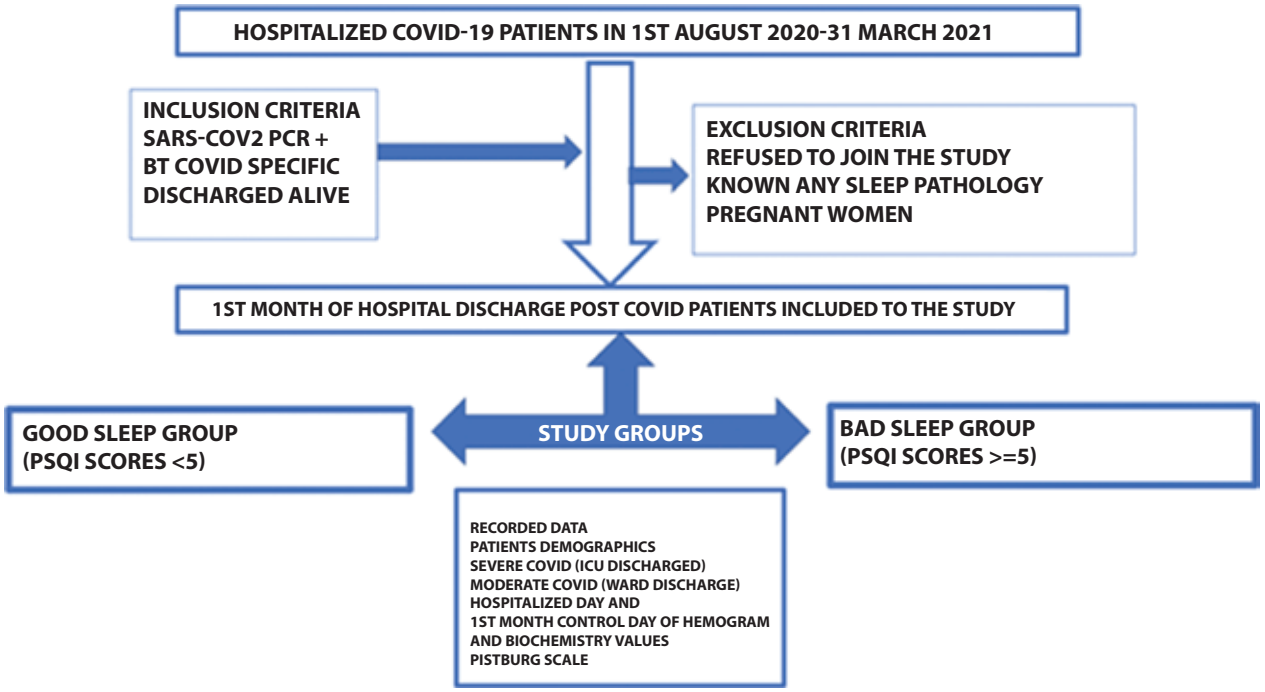

Figure 1. Flow Chart of COVID 19 Hospitalized Patients

group and those with scores 5 to the poor-sleep group. PSQI consisted of 18 items and seven dimensions, including sleep quality, sleep duration, sleep latency, habitual sleep efficiency and sleep disturbances, use of sleeping, medications, and daytime dysfunction. Each dimension was scored from 0–3, and the total score, which was the sum of the scores from each dimension, ranged from 0–20. A higher score indicated lower sleep quality (9).

Statistical Analysis

Number Cruncher Statistical System (NCSS) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. While evaluating the study data, descriptive statistical methods (Mean, Standard Deviation, Median, Frequency, Ratio, Minimum, Maximum), as well as the distribution of the data, were evaluated with the Shapiro-Wilk test were used. Wilcoxon test was used to determine the difference between the data of two periods of same patients that did not show normal distribution. Spearman's correlation analysis was used to determine the relationship between quantitative data. Significance was evaluated at $p<0.05$ levels.

Results

In the study period, 147 patients were admitted to our Post-COVID follow-up Outpatient Clinic between August 2020 and March 2021. Among the patients who applied, 83 patients who met our criteria were included in the study. The other 32 patients were isolated at home during their illness, 16 patients were hospitalized in an external center, 16 patients were admitted to the polyclinic after 40 days were -excluded from the study. The study included 83 patients, 49 (59%) male, who were admitted to the outpatient clinic at the 1st-month follow-up after being hospitalized in the Corona Service of SANKO University Faculty of Medicine. Their ages were found to range from 24 to 89, with an average of 57±14 years. The body mass index of the patients is 29±5 kg/m^2. The demographic characteristics of the patients are summarized in Table 1. The patients had a comorbid disease with 61%. Of these, 29% had hypertension, 19% had diabetes, 16% had asthma, 7% had COPD, and 6% had coronary artery disease. The length of hospital stay (days) was found to be range from 2 to 39, the median was 10 days. The length of stay in the intensive care unit (days) ranged from 0 to 19, the median was 4 days.

The patients had poor sleep quality with 56.6% (n=47) according to the Pittsburg scale. The decrease in sleep quality after the disease was found to be statistically significant ($p<0.01$). The sleep score value ranged from 0 to 20, the median was 5. The sleep duration (hour) value ranged from 3 to 11, with an average of 7.2±1.5. When asked, they stated that currently 28.9% (n=24) had good sleep quality, 47% (n=39) moderate and 24% (n=20) poor sleep quality. When the same patients were asked about their pre-disease sleep quality, 48% (n=40) reported good, 37% (n=31) moderate and 15% (n=12) poor sleep quality.

The duration of hospitalization, length of stay in the intensive care unit, body mass index, presence of additional diseases, mild, moderate, or severe corona process, smoking did not affect the sleep quality ($p>0,05$).

In the patients, 40.96% had shortness of breath, 39.75% weakness, 25.3% cough, 16.86% headache, 15.66% myalgia, 15.66% loss of appetite, 14.45% loss of taste, 13.25% dizziness, 12.04% loss of smell, 6.02% diarrhea, 4.81% fever, 2.4% had vomiting symptoms at the control and other symptoms did not affect sleep

Table 1. Demographic Variables

Variables		**N**	**%**
Educational Status	**Literacy**	11	13
	İlliterate	9	11
	Primary education	27	32
	High school	10	12
	Master/PhD	26	31
Smoking Status	**Smoking**	9	11
	Left	21	25
	Never smoked	53	64
Comorbid Disease	**Yes**	51	61
	No	5	6
Stay in the intensive care	**Yes**	25	30
	No	5	6

quality, except for dyspnea and loss of taste sensation. Only patients with dyspnea and loss of sense of taste had significantly worse sleep quality (p<0.01). Disease-related symptoms of individuals; it was scored as 0: no symptoms, 10: the most symptoms, and this evaluation was made both at the hospital admission and the first month of admission to the outpatient clinic. Also, the changes in symptoms at admission and 1st-month discharge were shown in Table 2 in poor sleep quality.

The relationship between sleep quality and some laboratory parameters in the control is given in Table 3, and sleep quality was significantly impaired only at d-dimer height, and the relationship between other laboratory parameters and sleep quality was not shown.

Favipiravir was given to 81.9% (n=68) of the patients and Plaquenil was given to 57.8% (n=48) of the patients at admission. Immune plasma was given to 67.5% (n=56) of the patients, steroid treatment was given to 49.4% (n=41) and Tocilizumab was given to 22.9% (n=19) of the patients at admission. Giving these treatments to the patients during hospitalization did not affect their sleep quality (p<0,05).

Discussion and Conclusion

In our study, the sleep quality of 83 patients who received inpatient treatment for COVID-19 disease was evaluated in the first month after discharge, and it was shown that the sleep quality of these people was impaired at a rate of 56.6%. The sleep score value for the 1st-month ranged from 0 to 20 median was 5. The sleep duration (hour) value ranged from 3 to 11, with an average of 7.2±1.5. The sleep quality of the

Table 2. Comparison of the Symptoms of the Bad Sleep Group

Variables	At Hospital Mean±SD Min-Max (Median)	1st-month Discharge Mean±SD Min-Max (Median)	p
Fever	4.33±3.65 0-10 (5.5)	0.41±1.87 0-10 (0)	**0.001***
Cough	3.11±3.63 0-10 (0)	1.2±2.32 0-10 (0)	**0.001***
Shortness of breath	3.59±3.61 0-10 (3.5)	2.61±2.91 0-10 (1.5)	**0.001***
Headache	3.7±3.7 0-10 (3)	1.33±2.73 0-8 (0)	**0.001***
Diarrhea	1.07±2.38 0-10 (0)	0.24±0.95 0-5 (0)	**0.001***
Myalgia	2.61±4.28 0-10 (0)	1.07±2.39 0-10 (0)	**0.001***
Loss of Taste	3.26±3.88 0-10 (0.5)	1±2.12 0-8 (0)	**0.001***
Anosmia	2.8±3.77 0-10 (0)	0.63±1.76 0-7 (0)	**0.001***
Dizziness	2.26±3.26 0-10 (0)	0.59±1.67 0-8 (0)	**0.001***
Weakness	6.43±3.49 0-10 (8)	2.41±2.99 0-9 (0)	**0.001***
Inappetence	3.96±3.63 0-10 (4)	0.8±2.17 0-10 (0)	**0.001***
Vomiting	1.43±2.93 0-10 (0)	0.02±0.15 0-1 (0)	**0.001***

*p<0,05

Table 3. Comparison of Laboratory Parameters by Sleep Status

Variables	Good Sleep	Poor Sleep	p
D-Dimer, median (%25-%75)	0.33 (IQR..)	0.40 (IQR..)	0.014*
Ferritin, median (%25-%75)	82.8(IQR..)	102.25(IQR..)	0.478
CRP, median (%25-%75)	2(IQR..)	2.98(IQR..)	0.547
WBC, median (%25-%75)	5990(IQR..)	6865(IQR..)	0.237
Hb, median (%25-%75)	14.5(IQR..)	13.95(IQR..)	0.233
HCT, median (%25-%75)	43.9(IQR..)	43.1(IQR..)	0.420
PLT, median (%25-%75)	273(IQR..)	273.5(IQR..)	0.945

*p<0,05

inpatient COVID-19 patients in the 1st-month outpatient control was significantly impaired. However, impaired sleep quality was not associated with the severity of the disease and any medications used for COVID-19. Among the current symptoms of the patients, only dyspnea and taste disturbances impaired sleep quality, and other symptoms did not affect sleep quality. Among the laboratory parameters examined, only D-dimer elevation was associated with the deterioration of sleep quality.

Many studies have been conducted on sleep quality after the COVID-19 pandemic, and these studies generally evaluated the sleep quality of the healthy people during the isolation process, the sleep quality of the health workers during this process, or the sleep quality of the patients during the hospitalization period, and the limited study was conducted on the sleep quality of the disease. A series of only 4 cases about sleep quality after discharge has been published, and in this case series, 4 post-COVID patients were evaluated with sleep quality through wrist actigraphy monitoring and Pittsburg sleep scale during the recovery period and they observed that patients who had a heavier hospitalization period due to COVID-19 had worse sleep quality (10). We evaluated the sleep quality of 83 patients, but we did not find a relationship between sleep quality and the severity of the disease.

In a study conducted on 180 healthcare workers in China, it was shown that the sleep scores of healthcare professionals were impaired and this was associated with stress and anxiety due to the isolated environment they worked in difficult working conditions (11). In our study, although sleep quality was impaired in the majority of patients, it was not associated with the duration of hospital stay or the severity of the disease.

Totally 279 COVID-positive patients were evaluated by telephone questionnaires on an average of 110 days after discharge, and the most common symptoms detected were 55% fatigue, 43% shortness of breath, 34% loss of memory, dyspnea 42%, 30.8% sleep problems (12). When we evaluated it monthly, the most common symptom was 40.96% shortness of breath, while fatigue was observed at a rate of 39.75%. In our study, 56.6% of the patients had poor sleep quality. In both studies, shortness of breath and fatigue were the two most common symptoms that persisted after hospitalization.

The sleep quality of 171 people who were in social isolation for fourteen days was measured on the 13th day of isolation with the Pittsburg scale (13). When the day was evaluated, it was shown that the sleep quality of the patients with low sociocultural levels was lower. However, no relationship was found between sleep quality and education level in our patients.

In the study by telephone survey, 2291 people who were in quarantine were included, and only 9% of the participants had COVID. The results revealed that 57.1% of participants reported poor sleep quality (14). In our study, 56.6% of patients had poor sleep quality. Sleep quality was similarly impaired in these two studies. In this case, having a disease does not impair the quality of sleep, but the quarantine process and the stress brought by the disease impair the quality of sleep.

In a study, the sleep quality of 71 patients whose sleep questionnaire was previously in the archive was examined 3 years later during the COVID-19

pandemic, and it was observed that their sleep quality deteriorated compared to before. And in this study, anxiety and deteriorated mood due to the pandemic period were shown as the cause of bad sleep (15). In our study, the sleep quality of the patients was impaired, but since we do not have a pre-disease sleep questionnaire, we do not show whether the sleep quality was impaired at that time. However, when we asked verbally, the patients in our study stated that their sleep quality was better before the disease.

In another study, 33 hospitalized COVID-19 patients were included in the study, and it was shown that as the patient's social support increased, sleep quality improved, and as the patient improved during the treatment process, sleep quality improved (16). In our study, the symptoms of the patients improved significantly, and sleep quality could not be associated with any of the current symptoms, except for dyspnea. However, the sleep quality of the patients who continued to have dyspnea was significantly worse.

In the study, 189 hospitalized patients were included and they were divided into two groups: good sleep quality and poor sleep quality according to the Pittsburg Sleep scale. It was shown that the group with poor sleep quality had a longer hospital stay and a worse history of depression (17).

In another study, the files of patients who were hospitalized for at least 2 weeks were retrospectively scanned, and their length of stay, lymphocyte levels, and severity of the disease were examined. These patients were reached within 3 weeks of discharge and their sleep quality was questioned during the two weeks they were hospitalized, 44.4% of these patients were evaluated as good sleep and 55.6% as bad sleep. It was shown that patients with poor sleep quality have longer hospital stays. Our study evaluated sleep quality in the first month after discharge, and no relationship was found between sleep quality and duration of hospital stay in this period (18).

A total of 72 studies (n>50000) of sleep disorders were analyzed with the assessment of C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor α (TNF) and ultimately CRP in sleep disorders, and IL-6 level increased, that is, the inflammatory response increased and TNF level did not change (4). We also looked at CRP and Ferritin levels in our study, but we could not find a difference in these values between good sleep and poor sleep. In our study, D-dimer was significantly elevated in patients with poor sleep quality. This may be due to the elevated levels of fibrinogen and increased platelet activity, promotes platelet adhesion and aggregation, and results in an impaired fibrinolytic capacity, especially in OSAS (19).

The limitation of our study is that the Pittsburg test was not applied to the patient during hospitalization. The patients were asked about their sleep quality during hospitalization and the patients interpreted their sleep quality as good, moderate, or bad. In the first month controls, both the Pittsburg test was applied to the patients and they were asked to evaluate their sleep quality as good, bad, and moderate. In sleep quality assessment, self-reports and Pittsburg test results were similar ($p>0.05$). The sleep quality after discharge was significantly impaired compared to the hospitalization day ($p<0.05$). Our study is the first study on post-discharge sleep quality. Further studies are needed to re-arrange the causes of sleep quality after hospitalization and sleep quality. Further studies are needed to find the reasons for the deterioration of sleep quality after hospitalization and to improve sleep quality. The sleep quality of COVID-19 patients was impaired in the 1st-month controls and was not associated with the severity of the COVID-19 disease.

Conflicts of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

References

1. Organization. Coronavirus disease (COVID-2019) situation reports. Consulted on April 1st 2020. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports
2. Ge H, Wang X, Yuan X, et al. The epidemiology and clinical information about COVID-19. Eur J Clin Microbiol Infect Dis 2020; 39: 1011–1019.
3. Liguori C, Pierantozzi M, Spanetta M, et al. Subjective neurological symptoms frequently occur in patients with SARS-CoV2 infection. Brain Behav Immun 2020; 88:11-6.
4. Irwin MR, Olmstead R, Carroll JE. Sleep Disturbance, Sleep Duration, and Inflammation: A Systematic Review

and Meta-Analysis of Cohort Studies and Experimental Sleep Deprivation. Biol Psychiatry 2016; 80(1): 40–52.
5. Irwin MR. Why sleep is important for health: a psychoneuroimmunology perspective. Ann Rev Psychol. 2015; 66:143–172.
6. Irwin M. Effects of sleep and sleep loss on immunity and cytokines. Brain Behav Immun 2002; 16: 503-512.
7. Gamaldo CE, Shaikh AK, McArthur JC. The sleep-immunity relationship. Neurol Clin 2012; 30: 1313-1343.
8. Sağlık Bakanlığı TC. COVID-19 Erişkin Hasta Yonetimi ve Tedavisi Rehberi. 22.03.2020.
9. Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh Sleep Quality Index. J Psychosom Res 1998; 45: 5–13
10. Vitale JA, Perazzo P, Silingardi M, et al. Is disruption of sleep quality a consequence of severe COVID-19 infection? A case-series examination. Chronobiology International 2020; 37 (7): 1110-1114.
11. Xiao H, Zhang Y, Kong D, et al. The Effects of Social Support on Sleep Quality of Medical Staff Treating Patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. Med Sci Monit 2020; 26: e923549-1.
12. Garrigues E, Janvier P, Kherabi O, et al. Post-discharge persistent symptoms and health-related quality of life after hospitalization for COVID-19. Letter to the Editor/ Journal of Infection 2020; 81 (6): e4–e6.
13. Xiao H, Zhang Y, Kong D, Li S, Yang N. Social Capital and Sleep Quality in Individuals Who Self-Isolated for 14 Days During the Coronavirus Disease 2019 (COVID-19) Outbreak in January 2020 in China. Med Sci Monit 2020; 26: e923921-1.
14. Casagrande M, Favieri F, Tambelli R, Forte G. The enemy who sealed the world: effects quarantine due to the COVID-19 on sleep quality, anxiety, and psychological distress in the Italian population: Sleep Medicine 2020; 75: 12-20
15. Targa, ADS, Benítez, ID, Moncusí-Moix A, et al. Decrease in sleep quality during COVID-19 outbreak. Sleep Breath 2021; 25(2): 1055-1061.
16. Xiao Y, Xiufang Y, Poornima K, et al. Social support and clinical improvement in COVID-19 positive patients in China. Nurs Outlook 2020; 68(6): 830-837
17. Akıncı T, Başar HM. Relationship between sleep quality and the psychological status of patients hospitalized with COVID-19. Sleep Medicine 2021; 80: 167-170.
18. Zhanga J, Xua D, Xiea B, et al. Poor-sleep is associated with slow recovery from lymphopenia and an increased need for ICU care in hospitalized patients with COVID-19: A retrospective cohort study. Brain, Behavior, and Immunity 2020; 88: 50–58.
19. Bikov A, Meszaros M, Schwarz EI. Coagulation and Fibrinolysis in Obstructive Sleep Apnoea. Int. J. Mol. Sci. 2021; 22 (6): 2834.

Correspondence:
Nevhiz Gündoğdu
İncili Pınar, Gazi Muhtar Paşa Blv. No:36,
27090 Şehitkamil/Gaziantep
Phone number: +90 532 540 18 26
E-mail: nevhizd@hotmail.com