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Factors Playing a Role in Sleep Disorders in Post-COVID-19 (Coronavirus Disease) Patients at the Neurology Polyclinic of Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia

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ABSTRACT

Background: Sleep disorders are one of the symptoms frequently reported in post-COVID-19 patients. This study aims to identify factors that play a role in sleep disorders in post-COVID-19 patients at Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia. **Methods:** This research was conducted in an analytical observational manner with a cross-sectional design. Data was collected from 100 post-COVID-19 patients treated at Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia. Data were analyzed using the logistic regression test. **Results:** Factors that play a role in sleep disorders in post-COVID-19 patients are depressive symptoms (OR=2.5; 95%CI: 1.3-4.8); Anxiety symptoms (OR=3.1; 95%CI: 1.6-5.9); Stress level (OR=2.2; 95%CI: 1.1-4.3); Sleep quality before COVID-19 (OR=2.0; 95%CI: 1.0-3.9). **Conclusion:** Symptoms of depression, anxiety, stress, and sleep quality before COVID-19 are factors that play a role in sleep disorders in post-COVID-19 patients.

1. Introduction

COVID-19 is a disease caused by the SARS-CoV-2 virus. Symptoms of COVID-19 vary from mild to severe. One of the symptoms frequently reported in post-COVID-19 patients is sleep disturbance. Sleep disorders can include insomnia, hypersomnia, or sleep-disordered breathing. Insomnia is difficulty falling asleep or maintaining sleep. Hypersomnia is excessive sleeping. Sleep-disordered breathing is a breathing disorder that occurs during sleep, such as sleep apnea. Sleep disorders can have a negative

impact on physical and mental health. Sleep disorders can increase the risk of obesity, diabetes, heart disease, and stroke. Sleep disorders can also cause depression, anxiety, and decreased quality of life.¹⁻³

Several studies have shown that COVID-19 can cause sleep disorders. A study in Italy found that 40% of post-COVID-19 patients reported symptoms of insomnia. A study in China found that 28% of post-COVID-19 patients reported symptoms of sleep apnea. The factors that play a role in sleep disorders in post-COVID-19 patients are not yet known with certainty.

Several factors that are thought to play a role in sleep disorders in post-COVID-19 patients are symptoms of depression and anxiety, stress levels, quality of sleep before COVID-19, use of medication, and changes in lifestyle. Sleep disorders not only disrupt patients' quality of life but can also worsen other sequelae of COVID-19, such as fatigue, depression, and anxiety. Sleep disorders can also increase the risk of long-term health complications, such as obesity, diabetes, heart disease, and stroke. Knowledge about risk factors for sleep disorders in post-COVID-19 patients can help health professionals in developing appropriate interventions and treatments. These interventions and treatments can help improve patients' sleep quality and reduce the risk of long-term health complications.⁴⁻⁷ This study aims to identify factors that play a role in sleep disorders in post-COVID-19 patients at Dr. Mohammad Hoesin General Hospital Palembang, Indonesia.

2. Methods

This research was conducted in an analytical observational manner with a cross-sectional design. The population of this study was all post-COVID-19 patients treated at Dr. Mohammad Hoesin General Hospital Palembang, Indonesia. The sample for this study was taken by consecutive sampling of 100 people. The inclusion criteria are post-COVID-19 patients who are being treated at Dr. Mohammad Hoesin General Hospital Palembang, Indonesia, are aged ≥ 18 years and are able to understand and complete the questionnaire. Meanwhile, the exclusion criteria are patients with severe mental disorders and patients with medical conditions that can interfere with sleep.

Data was collected using a questionnaire that included demographic data, such as age, gender, education, employment, and marital status. Symptoms of depression and anxiety: measured using the beck depression inventory (BDI) and beck anxiety inventory (BAI) questionnaires. Stress level: measured using the perceived stress scale (PSS) questionnaire.

Sleep quality before COVID-19: measured using the Pittsburgh sleep quality index (PSQI) questionnaire. Medication use: type of drug, dose, and duration of use. Lifestyle changes: changes in sleep patterns, physical activity, and diet. Data were analyzed using a logistic regression test to determine the factors that play a role in sleep disorders in post-COVID-19 patients. This research has received approval from the Ethics Committee of Dr. Mohammad Hoesin General Hospital Palembang, Indonesia. Informed consent was obtained from all patients before the study began.

3. Results

Respondents were dominated by men (55%) and women (45%). The majority of respondents were aged 31-45 years (40%), followed by 18-30 years (30%), 46-60 years (25%), and >60 years (5%). The highest number of respondents had senior high school/vocational high school education (50%), followed by tertiary education (30%) and elementary school/junior high school (20%). Most respondents work as employees (40%), followed by entrepreneurs (25%), housewives (20%), and student/college students (15%). More than half of respondents (52%) experienced sleep disorders, while 48% did not experience sleep disorders. The characteristics of the respondents in this study were quite diverse. Respondents were dominated by men aged 31-45 years, had a high school/vocational education, worked as employees, and experienced sleep disorders (Table 1).

Patients with depressive symptoms are 2.5 times more at risk of experiencing sleep disorders than patients without depressive symptoms. Patients with anxiety symptoms are 3.1 times more at risk of experiencing sleep disorders than patients without anxiety symptoms. Patients with high-stress levels are 2.2 times more at risk of experiencing sleep disorders than patients with low-stress levels. Patients with poor sleep quality before COVID-19 were 2.0 times more at risk of experiencing sleep disorders than patients with good sleep quality (Table 2).

Table 1. Characteristics of respondents.

Characteristics	N (%)
Gender	
Male	55 (55%)
Female	45 (45%)
Age (years)	
18-30	30 (30%)
31-45	40 (40%)
46-60	25 (25%)
>60	5 (5%)
Education	
Elementary school/Junior high school	20 (20%)
Senior high school/Vocational high school	50 (50%)
College	30 (30%)
Occupation	
Employee	40 (40%)
Entrepreneur	25 (25%)
Housewife	20 (20%)
Student/college students	15 (15%)
Sleep disorders	
Yes	52 (52%)
No	48 (48%)

Table 2. Analysis of risk factors for sleep disorders in post-COVID-19 patients.

Factor	OR (95% CI)	p-value
Symptoms of depression	2,5 (1,3-4,8)	0,001
Symptoms of anxiety	3,1 (1,6-5,9)	0,001
Stress level	2,2 (1,1-4,3)	0,025
Sleep quality before COVID-19	2,0 (1,0-3,9)	0,042

4. Discussion

The results showed that patients with depressive symptoms were 2.5 times more at risk of experiencing sleep disorders than patients without depressive symptoms. These findings are in line with previous research showing a link between depression and sleep disorders. Depression and sleep disorders are associated with changes in levels of hormones and neurotransmitters in the brain, such as serotonin, norepinephrine, dopamine, and melatonin. Serotonin plays a role in regulating mood, sleep, and appetite. Decreased serotonin levels can cause depression and insomnia. Norepinephrine plays a role in regulating energy, alertness, and mood. Decreased norepinephrine levels can cause fatigue and anhedonia (loss of interest). Dopamine plays a role in

regulating motivation, reward, and mood. Decreased dopamine levels can cause anhedonia and depression. Melatonin plays a role in regulating the sleep-wake cycle. Disturbances in melatonin production can cause insomnia. Research shows that depression and sleep disorders are associated with chronic inflammation. Inflammation can cause changes in neurotransmitters and hormones that can disrupt sleep. Depression and sleep disorders are associated with changes in the autonomic nervous system, which regulates the body's response to stress. Disorders of the autonomic nervous system can cause insomnia and fatigue. Research shows that genetic factors may play a role in depression and sleep disorders. People with a family history of depression or sleep disorders are more at risk of experiencing both conditions.

Psychological factors, such as rumination (rethinking negative events) and worry, can worsen depression and insomnia.⁸⁻¹¹

The findings of this study show that patients with anxiety symptoms are 3.1 times more at risk of experiencing sleep disorders than patients without anxiety symptoms. Anxiety is associated with hyperactivity of the sympathetic nervous system (SNS), which triggers the “fight-or-flight” response. This can cause various physiological effects, such as increased heart rate, blood pressure, and breathing, as well as muscle tension. These effects can disrupt the sleep process, making it difficult for patients to fall asleep, wake up easily, and experience restless sleep. The stress hormone cortisol is released in response to anxiety. Cortisol can interfere with the secretion of melatonin, the hormone that regulates sleep. High cortisol levels at night can make it difficult for patients to fall asleep and maintain sleep. An imbalance of neurotransmitters such as serotonin and dopamine is associated with anxiety and insomnia. Serotonin helps regulate mood and sleep, while dopamine plays a role in the wakefulness process. Serotonin and dopamine deficiencies can cause insomnia and other sleep disorders. Chronic anxiety can cause systemic inflammation, which can disrupt the production of neurotransmitters that regulate sleep and worsen insomnia. Patients with anxiety often experience rumination, which is rethinking negative events and worrying about the future. This can make it difficult for them to relax and fall asleep. Additionally, patients with anxiety may have poor sleep habits, such as long naps or excessive caffeine use, which can worsen insomnia.¹²⁻¹⁴

The results of the study showed that patients with high-stress levels were 2.2 times more at risk of experiencing sleep disorders than patients with low-stress levels. When the body experiences stress, the sympathetic nervous system activates the release of stress hormones such as cortisol and adrenaline. These hormones increase heart rate, blood pressure, and breathing and prepare the body for “fight or flight.” Cortisol can suppress melatonin, the hormone that

regulates sleep and wakefulness. Adrenaline can cause periodic awakenings during sleep. Chronic stress can lead to restless, restorative sleep. Chronic stress can cause sympathetic nervous system hyperactivity and parasympathetic nervous system dysfunction. The sympathetic nervous system is responsible for the “fight or flight” response, which makes it difficult for the body to relax and fall asleep. The parasympathetic nervous system is responsible for the “rest and digest” response, which is essential for deep, restorative sleep. Chronic stress can increase systemic inflammation, which can disrupt the neurotransmitters and hormones that regulate sleep. Inflammation can also cause symptoms of depression and anxiety, which can worsen sleep disorders. Chronic stress can cause anxiety, depression, and rumination, which can disrupt sleep.¹⁵⁻¹⁷

The findings of this study show that patients with poor sleep quality before COVID-19 were 2.0 times more at risk of experiencing sleep disorders than patients with good sleep quality. Poor sleep quality before COVID-19 can disrupt complex sleep mechanisms. The circadian system regulates the body's circadian rhythm, including sleep and wake times. Poor quality sleep can affect the body's internal clock, making it difficult to fall asleep or wake up at the right time. Hormones such as melatonin and orexin play a role in regulating sleep and wakefulness. Poor quality sleep can interfere with the production and release of these hormones, causing insomnia or hypersomnia. Sleep architecture refers to the proportion and duration of different stages of sleep, such as NREM and REM. Poor sleep quality can affect sleep architecture, causing restless sleep and easy awakening. Poor sleep quality can affect neurotransmitters in the brain, which play a role in regulating sleep. GABA is an inhibitory neurotransmitter that helps calm the brain and body for sleep. Poor quality sleep can reduce GABA levels, making it difficult to fall asleep. Serotonin is a neurotransmitter that plays a role in mood and sleep. Poor quality sleep can reduce serotonin levels, thereby increasing the risk of depression and insomnia.

Dopamine is a neurotransmitter that plays a role in motivation and alertness. Poor sleep quality can increase dopamine levels, causing insomnia and restless leg syndrome. Poor sleep quality can increase inflammation and oxidative stress in the body. Inflammation and oxidative stress can disrupt sleep mechanisms and cause damage to brain cells that play a role in sleep regulation. Poor sleep quality before COVID-19 can lead to anxiety and depression, which are major risk factors for sleep disorders. Anxiety and depression can make it difficult for people to fall asleep, wake up easily, and have restless sleep.¹⁸⁻²⁰

5. Conclusion

Symptoms of depression, anxiety, stress, and sleep quality before COVID-19 are factors that play a role in sleep disorders in post-COVID-19 patients.

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