The Relationship Between Sleep Quality and Hemodynamic Status Among Critical Patients

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Abstract

Objective: This study aims to investigate the association between sleep quality and hemodynamic status in critically ill patients admitted to the Intensive Care Unit, focusing on physiological stability and patient outcomes.

Method: A descriptive correlational study with a cross-sectional design was conducted. Sleep quality was assessed using the Richards-Campbell Sleep Questionnaire, while hemodynamic parameters were observed through routine clinical monitoring. The sample included 26 ICU patients who met the inclusion criteria: age ≥18 years, ICU stay of at least 24 hours, and a Glasgow Coma Scale (GCS) score ≥12.

Results: The majority of participants were male (61.5%). Diagnoses included coronary artery disease (42.3%), ST-elevation myocardial infarction (23.1%), congestive heart failure (26.9%), and ventilator-associated pneumonia (7.7%). Over half of the patients had comorbid conditions (53.8%). Poor sleep quality was reported by 38.5%, and very poor sleep by 46.2%. A statistically significant correlation was found between sleep quality and heart rate ($p = 0.031$).

Conclusion: Heart rate appears to be the most responsive hemodynamic parameter to changes in sleep quality. In contrast, SpO_2 and MAP are more affected by other clinical factors. Continuous monitoring of both sleep quality and heart rate is crucial for optimizing care in ICU patients, especially those with cardiovascular issues.

Keywords: Sleep quality, hemodynamic status, ICU, heart rate, critical care

INTRODUCTION

Intensive Care Unit (ICU) is a unit in a hospital that is often associated with patient morbidity and mortality. There are several most common indications for ICU admission, such as sepsis, trauma, and obstetric complications (Atumanya et al., 2020). Intensive Care Unit (ICU) is also often considered as an uncomfortable place for its residents. The intensive care unit environment greatly influences the patient's behavioral and sleep disorders compared to the disease they are experiencing (Iftikhar et al., 2019). According to Rosanti et al. (2020) there are several disorders that are often found in the ICU, such as cardiovascular disorders, respiratory disorders, neurological disorders and kidney disorders. Some diseases that are commonly found in the ICU include hypertension, dyslipidemia, coronary heart disease, heart failure, COPD, HIV, and acute kidney failure (Hollinger et al., 2019). Patients treated in the ICU are also known to be at risk of experiencing sleep disorders (Khoirunnisaa & Hudiyawati, 2019) and often experience hemodynamic instability (Suparti et al., 2021).

According to WHO (2019, around 9.8 to 24.6% of 100,000 people worldwide experience critical

illness and require intensive care. In fact, as many as 1.1 to 7.4 million patients have lost their lives in the treatment room due to critical illness. According to data released by the Kemenkes (2021), there are 2,979 hospitals in Indonesia with a total of 81,032 beds in the ICU. During 2021, there were 52,719 patients in critical conditions treated in the ICU, which means that around 64.83% of critical patients received treatment inthe ICU.

Hemodynamic status includes parameters such as systolic blood pressure, diastolic blood pressure, mean arterial pressure, stroke volume, heart rate, cardiac output, and total peripheral resistance, which are used to describe the condition of blood circulation in the body (Ikeda et al., 2022). Unstable hemodynamics are often found in critically ill patients treated in the Intensive Care Unit (ICU) (Khasanah et al., 2023). Hemodynamic instability in critically ill patients occurs when blood flow in the body is unstable. This can be associated with various conditions, including heart disease, which have the potential to cause hemodynamic instability. An unstable hemodynamic state increases the risk of serious complications that can result in death (Khasanah et al., 2023). In addition, hemodynamic status is also often associated with sleep disturbances due to arterial stiffness in patients (Culver et al., 2020).

Sari et al. (2021) stated that critical patients at ICU are known to often experience sleep disorders. Important causes of sleep disorders are environmental factors (such as noise and light), physiological factors (such as pain, immobility, discomfort and coughing), factors related to care (such as nursing care and medication), psychological factors, and most importantly the severity of the disease (Kakar et al., 2022). Lack of sleep is known to increase the risk of complications, such as delirium, length of stay in the ICU, and death (Elías, 2021).

A study conducted by Suparti et al. (2021), stated that there were variations in changes in hemodynamic scores before, during, and after sleep. Changes in HR and SpO2 were within the normal range. HR is a hemodynamic parameter that experiences significant changes in all three phases. Monitoring of patienthemodynamic values can be carried out in the phases before, during, and after sleep to determine the patient's physiological and psychological conditions so that they can play a role in the healing process. Laksono et al. (2022) also found that sleep duration can act asa predictor of cardiovascular disease which will affect the patient's hemodynamic status.

METHODS

Study design

This study was descriptive correlation with cross-sectional design.

Population and Sample

The population was patients at ICU. The sample was selected by using the convenience sampling technique. The minimumsample was calculated using G- power software. Inclusion criteria was patients aged ≥ 18 years old, admitted to the ICU for at least 24 hours, with GCS ≥ 12. Exclusion criteria included patients who were given sleep-inducing drugs such as narcotics and sedatives and patients with speechand hearing disorders.

Instruments

The Richards-Campbell Sleep Questionnaire (RCSQ) is a validated tool to assess the quality of sleep in critically ill patients, particularly in intensive care unit (ICU) settings. It comprises five items that evaluate different aspects of sleep, including depth, latency, awakenings, percentage of time asleep, and overall sleep quality. Each item is rated on a 100-mm visual analog scale, where higher scores indicate better sleep quality. The total score is calculated as the average of the five item scores. The reliability test results of this questionnaire reached 0.741, while the validity test showed a range between 0.449 to 0.644.

Hemodynamic status is measured by observing the following parameters in the patient's medical records: Mean Arterial Pressure (Normal value: 81-102 mmHg), Heart Rate (Normal value: 72-88 bpm), SpO2 (Normal value: 95%-99%).

Data Collection

Data collection was conducted by observation or clinical observation by trained researchers for hemodynamic status of patients. and distributed the questionnaire of the Richards-Campbell Sleep Questionnaire (RCSQ).

Data analysis

Statistical analysis was performed utilizing SPSS 25.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Bivariate analysis was used the Spearman Rank CorrelationTest.

RESULTS

Table 1. Characteristics of the Respondent (N=26)

Variable	Mean Score (Range)	F (%)
Age	61.96 (44 - 75)	
Heart Rate	92.77 (59 – 121)	
SPO2	96.81 (92 – 100)	
MAP	84.35 (66 – 110)	
Gender		
Male		16 (61.5 %))
Female		10 (38.5 %))
Cardiovascular Disorders		
CAD		11 (42.3 %)
STEMI		6 (23.1 %),
CHF		7 (26.9 %)
VAP.		2 (7.7 %)
Comorbid		
Yes		14 (53.8%)
No		12 (46.2 %)
Sleep Quality		
Good		4 (15.4 %)
Poor		10 (38.4 %)
Very Poor		12 (46.2 %)

Table 1 showed that average age of the respondent was 62 years old. More than half of the respondents were male (61.5%). The cardiovascular disorders, with a distribution of CAD (42.3%), STEMI (23.1%), CHF (26.9%), and VAP (7.7%). Most respondents had comorbidities (53.8%). The average heart rate was 92.77, average of SpO2 was 96.81, average of MAP was 84.35. More than a quarter of the respondents had poor sleep quality (38.5%), and almost half of the respondents had very poor sleep Quality (46.2%)

Table 2. Relationship between Sleep Quality

Varibale		**Heart Rate**	**SpO2**	**MAP**
Sleep Quality	***r***	0.423	0.053	0.366
	p-value	0.031	0.798	0.066

Table 2 showed there was only heart rate significantly correlation with sleep quality with (r) = 0.423 and P-value 0.03 (≤ 0.05).

DISCUSSION

Patients in the Intensive Care Unit (ICU) often experience poor sleep quality due to a combination of environmental, physiological, and psychological factors. The ICU environment is typically characterized by constant noise from alarms, medical equipment, and staff activities, as well as exposure to bright lights, which disrupt the natural circadian rhythm and reduce sleep duration (Friese, 2008). Physiologically, critical illnesses and the need for life-support measures, such as mechanical ventilation, can cause discomfort and interfere with sleep patterns (Pisani et al., 2015). Additionally, frequent medical interventions, such as monitoring vital signs and administering medications, fragment sleep cycles and prevent restorative sleep (Kamdar et al., 2012).

Psychological stress, including anxiety about illness and fear of outcomes, further

contributes to sleep disturbances (Elliott et al., 2014). Moreover, the use of sedatives and analgesics, while intended to alleviate discomfort, can alter sleep architecture, often reducing the amount of deep and rapid eye movement (REM) sleep necessary for recovery (Watson et al., 2012). These multifactorial disruptions to sleep have significant implications for patient outcomes, as poor sleep quality in the ICU is associated with prolonged recovery times, delirium, and impaired immune function. Addressing these issues through environmental modifications and targeted interventions is critical for improving sleep quality and overall patient care in the ICU. Sleep quality significantly had correlation with heart rate. Poor sleep quality in critical patients in the ICU can cause a decrease in hemodynamic parameters, especially the patient's heart rate. This is evidenced by a study conducted by Suparti et al. (2021) which stated that there were variations in changes in hemodynamic scores before, during, and after sleep. HR is a hemodynamic parameter that experiences significant changes in all three phases. In addition, Sajjadieh et al. (2020) also stated that poor sleep quality is related to HR (Heart Rate). This study confirms that lack of sleep can have a negative impact on a person's cardiovascular system function, especially the patient's heart rate. Decreased cardiovascular system function can increase the risk of developing and dying from coronary artery disease and stroke. Therefore, monitoring sleep quality and hemodynamic status is essential in the care of critical patients in the ICU.

CONCLUSION

Heart rate is the most sensitive hemodynamic parameter to changes in sleep quality. Changes in sleep quality can trigger rapid changes in heart rate, while SpO2 and MAP tend to be more influenced by other factors such as respiratory conditions and kidney function. Therefore, monitoring sleep quality and heart rate is essential in the care of critical patients in the ICU, especially in patients with cardiovascular disorders.

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Conflict of Interest

The authors declare no competing interests related to the conduct or publication of this research.

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