- ***Reviewer***

Sleep Concept: and Nursing Role toward Intensive Care Unit Patients

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Abstract

Background: Sleep is an essential component of recovery for ICU patients, particularly those recovering from surgery. Sleep disturbances in the ICU are common and have significant implications for patient outcomes, including increased morbidity and mortality. Nurses have a vital role in managing sleep disturbances through a combination of environmental modifications, non-pharmacological interventions, and proper pain management. By prioritizing sleep as part of holistic care, nurses can help improve patient recovery times and overall health outcomes. Aim: This review aims to enhance the understanding of sleep management in critical care settings, guiding healthcare professionals in optimizing patient recovery.

Keywords: Intensive Care Unit, Nursing Role, Patients, Sleep Concept

Introduction

Sleep is a vital physiological process that allows the body and mind to rest and recover. It is regulated by the circadian rhythm, which is driven by the body's internal clock and influenced by environmental factors such as light and temperature. Sleep serves several key functions, including energy conservation, physical repair, and cognitive processing. Without adequate sleep, individuals experience impaired immune function, cognitive deficits, and increased vulnerability to illness. In clinical settings, especially in ICUs, sleep disturbances are common and can have significant implications for patient recovery (Meyer et al., 2022).

1.1.Normal sleep pattern

Sleep is a complex biological process essential for maintaining physical and mental health. It is typically divided into two main states: non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. These two states cycle throughout the night in a predictable pattern, with each cycle lasting approximately 90 minutes. A healthy adult will experience 4-6 complete sleep cycles per night, alternating between NREM and REM sleep. Each stage of sleep serves specific functions vital for recovery, restoration, and cognitive processing (Pandi-Perumal et al., 2022).

1.1.1. Non-rapid eye movement (NREM) sleep

NREM sleep accounts for about 75% of the total sleep time in adults and is characterized by slower brain waves, decreased muscle activity, and reduced physiological activity (heart rate and respiration). NREM sleep is further divided into three distinct stages (Le Bon, 2020).

Stage 1 (light sleep): This is the transition period between wakefulness and sleep, lasting only a few minutes (around 5-10% of total sleep time). During stage 1, brain activity slows down, and the body begins to relax, with muscle twitches and slower breathing. This stage is the lightest form of sleep and is easily disrupted by external stimuli like noise or light.

Stage 2 (moderate sleep): This stage marks the onset of true sleep, comprising around 45-55% of total sleep time. In stage 2, heart rate and body temperature decrease, and the brain produces bursts of rhythmic brain waves known as "sleep spindles" and "K-complexes," which are believed to play a role in memory consolidation. Sleep during this stage is more stable than in Stage 1, though people are still relatively easy to wake.

Stage 3 (deep sleep): Also known as slow-wave sleep (SWS) or delta sleep, Stage 3 is the deepest stage of NREM sleep and accounts for about 15-25% of total sleep time. During this stage, brain activity is at its slowest, with delta waves dominating the EEG pattern. Muscle activity, heart rate, and respiration are significantly reduced. Deep sleep is crucial for physical restoration, tissue repair, immune function, and the release of growth hormones.

Deep sleep has been shown to play a critical role in immune system function, muscle recovery, and the removal of toxins from the brain. Many researches found that; the reduction in slow-

wave sleep is associated with an increased risk of metabolic disorders and weakened immune responses (Saxvig et al., 2021).

1.1.2. Rapid eye movement (rem) sleep

REM sleep accounts for 20-25% of total sleep time in adults and is characterized by increased brain activity, vivid dreaming, and rapid movement of the eyes under the eyelids. Unlike NREM sleep, REM sleep is associated with the body's physiological arousal (Chaput et al., 2020).

Brain activity: During REM sleep, the brain becomes highly active, showing EEG patterns similar to wakefulness. This heightened brain activity supports cognitive functions such as memory consolidation, emotional regulation, and learning. Muscle atonia: While brain activity increases during REM sleep, the body remains largely immobile due to a temporary paralysis of most muscles, a mechanism that prevents individuals from acting out their dreams. Dreaming: Most vivid dreams occur during REM sleep, and dreaming is thought to play a role in emotional regulation and problem-solving (Gentry et al., 2021).

The alternating stages of NREM and REM sleep make up one complete sleep cycle, which lasts approximately 90 minutes. A healthy adult experiences about 4-6 sleep cycles per night, with the distribution of time spent in NREM and REM stages changing throughout the night: Early in the night, the majority of sleep time is spent in deep NREM sleep (Stage 3), which is essential for physical recovery. As the night progresses, REM sleep periods become longer and more frequent, while deep sleep periods shorten (Foster, 2020).

1.2.Sleep in different life stages:

- Newborns: Infants require around 14-17 hours of sleep per day, with about 50% of that time spent in REM sleep. Their sleep cycles are shorter, typically lasting 50-60 minutes.
- Adults: Adults generally require 7-9 hours of sleep per night. As adults age, their need for sleep remains the same, but structured pattern of sleep cycles change. Older adults experience shorter deep sleep phases and more fragmented sleep.
- Older Adults: The proportion of deep sleep decreases with age, while the time spent in lighter sleep stages increases. This often leads to more frequent awakenings during the night and a reduced ability to feel rested after sleep (Jonasdottir et al., 2021).

1.3.Factors affecting normal sleep patterns: Several factors can influence the normal sleep quality:

- Circadian Rhythm: The body’s internal clock, regulated by the hypothalamus, controls the sleep-wake cycle, typically promoting sleepiness at night and alertness during the day. Exposure to light, especially blue light from screens, can disrupt this rhythm, delaying sleep onset (Meyer et al., 2022).

- Environmental Factors: Noise, light, and temperature in the sleep environment can significantly affect sleep quality. A quiet, dark, and cool room typically promotes better sleep (Slavish et al., 2021).
- Lifestyle Factors: Diet, exercise, stress, and substance use (e.g., caffeine, alcohol, or medications) all impact sleep patterns. For example, caffeine consumed late in the day can delay sleep onset, while alcohol can disrupt REM sleep, leading to fragmented sleep (Pandi-Perumal et al., 2022).

2. Abnormal sleep pattern

Abnormal sleep refers to deviations from the normal sleep architecture, leading to sleep disorders. Common sleep disorders include: Insomnia: Difficulty falling or staying asleep, often exacerbated by stress, anxiety, or medical conditions. Obstructive Sleep Apnea (OSA): A condition where breathing repeatedly stops during sleep due to airway obstruction. OSA is prevalent in ICU patients, especially those post-operatively, with rates ranging from 19.2% to 50.2% (Chan et al., 2019). Restless Legs Syndrome: A neurological disorder that causes uncomfortable sensations in the legs, often interfering with sleep.

2.1.Physiological and psychological impact of sleep deprivation

Sleep deprivation is a significant concern, especially in clinical settings like ICUs, where patients often experience disrupted or inadequate sleep due to various factors, including pain, anxiety, medications and environmental disturbances. The effects of sleep deprivation are profound and can negatively impact both physiological and psychological health, leading to delayed recovery, increased complications, and heightened risks of mortality (McCarthy, 2021).

2.1.1 Cognitive impairment

Sleep deprivation leads to notable deficits in cognitive functioning, affecting memory, attention, decision-making, and overall mental clarity.

- Memory and attention deficits: Prolonged lack of sleep impairs working memory and the ability to focus. This can be particularly dangerous in ICU settings, where patients need to make decisions about their care and follow instructions. Post-operative patients in ICUs may struggle with confusion and memory lapses.
- Decision-making and executive function: Sleep deprivation affects the prefrontal cortex, the area of the brain responsible for higher-order functions such as decision-making, problem-solving, and emotional regulation. This can result in poor decision-making abilities, especially in high-stress environments like the ICU (Freeman et al., 2020).

- Delirium in ICU patients: Delirium is a common manifestation of severe sleep deprivation, especially in ICU patients. Delirium involves sudden confusion and disorientation and can significantly affect recovery outcomes. Studies show that delirium rates in ICU patients range from 30% to 50% (McCarthy, 2021). Delirium can also be associated with longer ICU stays, increased mortality rates, and long-term cognitive decline (Freeman et al., 2020).
- According to the American Academy of Sleep Medicine (AASM), individuals who experience total sleep deprivation for 24 hours have cognitive abilities comparable to those with a blood alcohol content of 0.10%, which is above the legal limit for driving in many countries (Freeman et al., 2020).
- ICU patients with sleep deprivation are more likely to develop delirium, with a prevalence ranging from 31% to 87%, depending on the specific population and clinical conditions (McCarthy, 2021).

2.1.2 Immune function

Adequate sleep is essential for the proper functioning of the immune system. Sleep deprivation compromises immune responses, making individuals more vulnerable to infections, slower to heal, and less resilient overall.

- Impaired immune response: During sleep, the body produces and releases cytokines, proteins that help regulate the immune response. Sleep deprivation reduces the production of these cytokines, weakening the body's ability to respond to infections and inflammation (Jahrami et al., 2022).
- Tissue repair and healing: Sleep is crucial for cell and tissue repair. Deep sleep, particularly slow-wave sleep, promotes the release of growth hormones, which are essential for wound healing and tissue recovery, particularly for post-operative patients (McCleery & Sharpley, 2020). A lack of adequate sleep slows down the healing process, which is detrimental for ICU patients recovering from surgeries or other invasive procedures.
- Several studies found that individuals who sleep fewer than six hours per night were four times more likely to catch a cold after being exposed to the virus than those who slept more than seven hours. In post-operative patients, sleep deprivation has been linked to an increased risk of post-operative infections and longer recovery times (McCleery & Sharpley, 2020).

2.1.3 Cardiovascular effects

Sleep deprivation is associated with several cardiovascular risks, including hypertension, arrhythmias, myocardial infarction, and stroke. These risks are particularly concerning for ICU patients, especially those recovering from cardiac surgeries (Zuraikat et al., 2020).

- Increased risk of hypertension: Chronic sleep deprivation is linked to elevated blood pressure. Studies show that people who sleep fewer than six hours per night are at a significantly higher risk of developing hypertension, as sleep plays a key role in regulating stress hormones and maintaining blood pressure at healthy levels (Makarem et al., 2021).
- Arrhythmias and cardiac events: Lack of sleep disrupts the autonomic nervous system, leading to imbalances between the sympathetic (fight or flight) and parasympathetic (rest and digest) systems. This imbalance can trigger arrhythmias (irregular heartbeats) and increase the risk of cardiovascular events like myocardial infarction and stroke, especially in vulnerable populations such as ICU patients (Makarem et al., 2021).
- Impact on post-operative patients: Patients recovering from cardiac surgery are particularly vulnerable to the cardiovascular effects of sleep deprivation. Lack of sleep increases the risk of post-operative atrial fibrillation, heart attacks, and other complications. Studies suggest that patients with untreated sleep disorders, such as obstructive sleep apnea, have a 50% higher risk of post-operative cardiovascular complications (Makarem et al., 2021).
- A meta-analysis of sleep duration and cardiovascular disease found that individuals who sleep fewer than six hours per night have a 48% increased risk of developing or dying from coronary heart disease (McCarthy, 2021).

2.1.4 Metabolic and **endocrine effects**

Sleep deprivation also disrupts the regulation of metabolic and endocrine processes, which can have severe consequences for ICU patients.

- Insulin resistance and diabetes: Chronic sleep deprivation increases insulin resistance, a condition in which the body's cells do not respond effectively to insulin. This can lead to elevated blood sugar levels and an increased risk of developing type 2 diabetes (Jahrami et al., 2022).
- Increased cortisol levels: Lack of sleep triggers an increase in cortisol, the body’s primary stress hormone. High levels of cortisol contribute to increased blood sugar levels, fat accumulation (especially abdominal fat), and high blood pressure, all of which can worsen ICU patients' health (McCleery & Sharpley, 2020).
- Hormonal imbalance: Sleep deprivation also leads to reduced production of hormones like leptin and ghrelin, which regulate hunger and satiety. This disruption can increase appetite and lead to overeating, which may complicate the management of post-operative patients in ICU settings, especially those recovering from bariatric or other metabolic-related surgeries (Jahrami et al., 2022).
- A large cohort study found that individuals who sleep fewer than six hours per night are 30% more likely to develop type 2 diabetes than those who sleep seven to eight hours per night (Varma et al., 2020).

2.1.5 Emotional and **psychological impact**

Sleep deprivation also significantly affects emotional regulation and mental health. ICU patients, particularly those with prolonged stays, are at risk of developing anxiety, depression, and mood disorders due to chronic sleep deprivation.

- Mood disturbances: Sleep-deprived individuals often experience irritability, mood swings, and heightened emotional responses. For ICU patients, sleep deprivation exacerbates existing stress and anxiety related to their medical condition (Freeman et al., 2020).
- Depression and anxiety: Chronic sleep deprivation is a well-established risk factor for the development of mood disorders such as depression and anxiety. Studies show that individuals with insomnia are 10 times more likely to develop depression than those who sleep well (Lin et al., 2021).
- Suicidal ideation: Severe sleep deprivation has also been linked to an increased risk of suicidal ideation. ICU patients already dealing with severe illnesses may be particularly vulnerable to these emotional disturbances, emphasizing the need for comprehensive sleep management in critical care settings (Jahrami et al., 2022).
- A meta-analysis of studies examining the relationship between sleep and mental health found that individuals with sleep disorders were more than twice as likely to experience depression (Freeman et al., 2020).
- Research published in the Journal of Clinical Sleep Medicine showed that sleep deprivation in ICU patients is associated with an increased risk of developing post-traumatic stress disorder (PTSD) following discharge (Jahrami et al., 2022).

3. Sleep disturbances in ICU patients

In ICU settings, sleep abnormalities are exacerbated by multiple factors, including pain, medication side effects, and the intensive care environment itself. ICU patients are particularly prone to sleep disturbances due to the constant monitoring, noisy environment, and frequent medical interventions. Studies show that over half of ICU patients suffer from sleep deprivation, with approximately one-third reporting that their sleep issues persist after discharge (Shih et al., 2023).

3.1. Causes of sleep disturbance in ICU

Noise: Monitors, ventilators, alarms, and conversations are major contributors to ICU noise. Noise levels in ICUs often exceed the recommended 30-35 decibel range, disrupting sleep. Light: Bright artificial lighting affects the circadian rhythm by inhibiting melatonin production, essential for sleep regulation. Medical Interventions: Frequent interruptions for vital signs monitoring, medication administration, and repositioning disrupt sleep continuity, further contributing to sleep deprivation (Chan et al., 2019).

Patients undergoing surgery, particularly open-heart surgery, often experience significant sleep disturbances post-operatively: Sleep Fragmentation: Studies show that post-operative patients may only achieve 1-4 hours of fragmented sleep in the first few days after surgery. This pattern persists for several days, with patients experiencing frequent awakenings. Contributing Factors: Pain, especially from surgical wounds, chest tubes, and discomfort, plays a major role in disrupting sleep (Auckley& Memtsoudis, 2019).

Post-operative patients also face anxiety, stress, and the effects of medications such as sedatives and analgesics, which interfere with sleep quality. Long-Term Consequences: Poor sleep post-surgery has been linked to slower recovery times, prolonged hospital stays, and a higher likelihood of complications. Approximately 50% of cardiac surgery patients experience sleep disturbances lasting up to six months post-surgery (Varallo et al., 2022).

4. Role of nurses in promoting sleep in ICU patients

Nurses play a crucial role in managing sleep disturbances in ICU patients by employing both pharmacological and non-pharmacological interventions: Nurses should assess sleep quality using tools like the Pittsburgh Sleep Quality Index (PSQI) or the Sleep Numeric Rating Scale, which allow patients to rate their sleep on a scale from 0 to 10 (He et al., 2022).

Non-Pharmacological Interventions: Environmental adjustments; reducing noise levels, dimming lights, and scheduling care activities to minimize interruptions can significantly improve sleep quality. Comfort measures; providing proper positioning, pain management and relaxation techniques (e.g., guided imagery, deep breathing exercises) can help patients relax and improve their sleep (Wu et al., 2022).

4.1. Evidence-based nursing interventions

Nursing interventions aimed at improving sleep quality in ICU patients should focus on: Noise reduction: Introducing earplugs, white noise machines, and quieter equipment can reduce noise pollution in ICUs. Studies have shown that reducing noise can improve sleep quality and reduce stress in patients. Light regulation: Utilizing eye masks and dimming lights at night can help regulate the circadian rhythm and promote melatonin production, essential for sleep onset (Armstrong et al., 2022).

Pain management: Adequate pain control through scheduled analgesics, proper positioning, and wound care is critical for promoting restful sleep. Research shows that addressing pain early can reduce the impact of sleep disturbances. Emotional support: Providing reassurance, explaining medical procedures clearly, and addressing patient anxieties can significantly reduce stress and improve sleep quality. Psychological distress has been identified as a major factor in ICU sleep disturbances (McCann et al., 2023).

4.2.Challenges in managing sleep in ICU

Despite the many strategies available, managing sleep in ICU settings poses several challenges: medical priorities vs. sleep: Frequent interventions for monitoring, treatment, and care often take precedence over promoting sleep. Finding the right balance between necessary medical care and preserving sleep remains a key challenge. Individualized care: Each patient's needs and conditions differ, making it necessary to customize sleep management strategies. For example, elderly patients may require different approaches compared to younger ones due to variations in sleep architecture and comorbidities (Bozkul, Arslan& Çelik, 2023).

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الملخص العربي

مقدمه: يعد النوم من العناصر الأساسية في تعافي مرضى وحدات العناية المركزة، خاصة أولئك الذين يتعافون من الجراحة. كما تعد اضطرابات النوم من المشاكل الشائعة في وحدات العناية المركزة ولها تأثيركبير وملاحظ على نتائج المرضى، بما في ذلك زيادة معدلات الأمراض والوفيات. ويلعب الممرضون دورًا حيويًا في إدارة اضطرابات النوم من خلال الجمع بين التعديلات البيئية، التدخلات غير الدوائية، والإدارة الجيدة للألم من خلال إعطاء الأولوية للنوم كجزء من الرعاية الشاملة، وبذلك يمكن للممرضين المساهمة في تحسين أوقات التعافي لدى المرضى وتحسين النتائج الصحية العامة لديهم.

الهدف: يهدف هذا المقال إلى تعزيز فهم إدارة النوم في بيئة الرعاية الحرجة، وتوجيه مقدمى الرعاية الصحية نحو تحسين تعافي المرضى.