IMPROVING SLEEP IN JORDANIAN INTENSIVE CARE UNIT PATIENTS

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Introduction

Sleep is essential for well-being and recovery from illness. The critically ill are in significant need of sleep but at increased risk of sleep loss and disruption (Elliot et al.,2011). Sleep is considered to be physically and psychologically restorative and essential for healing and recovery from illness (Elliot et al.,2011).

Sleep disturbance is one of the common factors associated with hospitalized patients (Friese et al., 2007; Hardin, 2009). In particular, sleep disturbance often occurs in patients in a critical care unit [(Feeley and Gardner, 2006), reviewed in (Tembo and Parker, 2009)].

Many previous studies tried to determine the possible factors that cause sleep disturbances in ICU`s patients, and study the category factors as intrinsic and extrinsic; other classifications are patient-related factors (e.g., disease severity) and environmental factors (e.g., light, noise, and medications) (Drouot et al., 2008).

In general, possible causes lead to discomfort as stated by Elliot et al., including sleep disturbances, are noisy environment, illness symptoms, treatment- itself or devices used in care such as artificial airway and intravascular catheters and medications.

Studies used different tools to assess sleep process quality (fragmentation, sleep stage changes, wake after sleep onset, EEG sleep patterns), quantity (total sleep time and time spent in each sleep stage) and distribution over the 24-hour cycle in ICU patients. The most used methods were polysomnography (PSG), nursing observations, and Subjective measures of sleep including questionnaires incorporating visual analogue and Likert scales, for example the Richards Campbell Sleep Questionnaire (RCSQ), the Sleep in the Intensive Care Unit Questionnaire (SICQ) and the Verran/Snyder Halpern (VSH) Sleep Scale (Snyder-Halpern and Verran, 1987). Full PSG remains the gold standard for sleep scoring but practical considerations have generated interest in alternative methods (Drouot et al.,2008).

Problem statement

Given the current evidence of sleep disruption in ICU patients and epidemiological evidence of the long-term adverse health consequences of poor sleep, there is a need to perform well designed interventional studies. Few studies have attempted to improve sleep for ICU patients (Elliot et al.,2012). An urgent need for modifying ICU's organizational and behavioral environment to make ICU more comfortable and suitable for clients' sleep suggested comparative studies to evaluate these complex interventions are needed. Despite the significance of the problem, few previous studies used experimental study design or included an intervention to overcome sleep disturbances among ICU patients; beside that no previous study in Jordan was found related to this topic. This study is a randomized control trial designed to evaluate the effects of modifying some possible causes of sleep deprivation among ICU patients, of their sleep.

Sleep in adults comprises one consolidated period of 6-8 hours of total sleep time (TST) in each 24 hour period occurring at night. The Sleep Efficiency Index (SEI), an alternative method of representing the quantity of sleep, is the fraction of time spent asleep during the duration of sleep monitoring (or the TST divided by the total time in bed after all lights are turned off to time of awakening). The expected SEI for a healthy adult is approximately 80-85% (Ohayon et al., 2004). Sleep duration declines with advancing age (that is from an expected TST of 7.5 h and SEI of 80% at 25 years to 5-6 h and 77% at 85 years) (Ohayon et al., 2004).

Study purpose

The aim of this study is to examine the effectiveness of modifying ICU`s light, noise, and daily nursing care time on improving patient`s Sleep Total Time (STT), and Sleep Efficacy (SE) in Jordanian university hospitals in comparison with usual ICU environments and nursing care.

Study Hypothesis

Modifying ICU`s light, noise and daily nursing care time will improve ICU`s patients' sleep as measured by Sleep Efficiency (SE) and Total Sleep Time (TST).

Significance

As previously mentioned, sleep has significant effects on health, promoting healing, and preventing deterioration specially for critically ill patients; also sleep disturbances increase morbidity and mortality (Elissen & Hopstock, 2011). Many studies have determined the impact of sleep disturbances on patient`s health, for example one literature review suggested that the adverse health effects of poor sleep are understood and have short and long-term sequences including poor cognition, susceptibility to infection and even cancer and cardiovascular disease (Ferrie et al., 2007; Gallicchio & Kalesan, 2009). It is also clear that acute brain dysfunction, specifically delirium, has been implicated in sleep disruption in ICU patients, however, until the exact mechanism is identified it is impossible to differentiate whether sleep disruption leads to brain dysfunction or vice versa (Cochen et al., 2005; Roche Campo et al., 2010). Another study confirmed the previous data and assure that Sleep deprivation may cause impaired immune function, ventilatory compromise, psychosis and delirium (de Almeida, 2009).

As sleep importance for patients in general and for ICU patients specifically was proved, an intervention is needed to prevent significant consequences on health and healing process and to prevent prolonged hospitalization period. While the possible factors affect patient`s sleep in ICU are clear now, few interventional studies have been done. One study in France by Drouot et al in 2008 that tried to modify factors involved in sleep disruption such as noise, continuous nursing care, and continuous light exposure showed very promising results that improved patients' sleep significantly.

Literature Review

There are two main sleep states, rapid eye movement sleep (REM), which comprises approximately 25% of TST, and non-rapid eye movement sleep (non-REM) (75% of TST) (Ohayon et al., 2004). REM sleep declines slightly with aging from 25% in early adulthood to 16-18% at 85 years. The proportion of non-REM sleep does not decline with age but the proportion of light sleep, particularly stage 2 sleep, increases and slow wave sleep decreases (Ohayon et al., 2004). There are four stages of non-REM sleep: stages 1 and 2 or light sleep; stages 3 and 4 or slow wave sleep (SWS). These represent increasing depths of sleep and are usually completed in sequence in order to enter REM sleep (Krygeret al., 2005). The consolidated sleep period consists of four to six sleep cycles - stages 1-4 followed by REM sleep - which lasts 60-90 minutes. Time spent awake during the sleep period is less than 5% of TST. Arousals (emergence into lighter stages of sleep on the electroencephalograph (EEG)) are also a feature of sleep; an adult population norm (measured in the sleep investigation laboratory) is 10-22 arousals per hour (Bonnet and Arand, 2007).

Factors that Affect Sleep in ICU Patients

Evidence has suggested that sleep disruption is most likely due to a combination of intrinsic and external factors which impact differently across patients according to each particular circumstance (Tembo & parker, 2009). Noise from equipment such as alarms from the monitors, ventilators and other equipment, together with staff related noise and ringing telephones were commonly reported causes of sleep disruption in ICU (Kass, 2008; Coyer et al., 2007). Change of sleep habits, use of sedatives and other medications, and disease severity may be a major factor in sleep fragmentation. Significantly greater numbers of arousals and awakenings per hour were found in patients with higher severity scores and in patients who died (Parthasarathy, 2003). However, sleep may be affected also by many other factors, such as pain, discomfort, anxiety, mood disorders, nursing care, and mechanical ventilation. The exact role of mechanical ventilation in sleep fragmentation in ICU patients remains poorly understood, despite that sleep fragmentation due to poor patient-ventilator interaction may contribute to the occurrence of brain dysfunction seen in mechanically ventilated patients. Recent studies suggest that the ventilatory mode and its settings, as well as patient-ventilator interactions, may influence the degree of fragmentation and the quality of sleep (Bosma et al., 2007; Cabello et al., 2006).

Sleep Disturbances and Delirium

Delirium and poor sleep quality are common and often co-exist in hospitalized patients. A possible link between these disorders has been hypothesized but whether this link is a cause-and-effect relationship or simply an association resulting from shared mechanisms is yet to be determined (Watson & Fanfulla 2012). A possible explanation of this relationship is neurotransmitter imbalance hypotheses, with dopamine and acetylcholine felt to be the most important neurotransmitters involved. An imbalance of these same neurotransmitters also occurs in association with sleep deprivation(Gabor & Cooper, 2001). During delirium the levels of acetylcholine are generally thought to be low and those of dopamine high, though a few reports tend to hypothesize the opposite imbalance (high acetylcholine and low dopamine) (Trzepacz, 2000). The importance of dopamine on the development of delirium, in particular, seems to be supported by the therapeutic effect of haloperidol, a powerful dopamine blocker.

In addition to acetylcholine and dopamine, there is evidence that other neurotransmitters such as tryptophan can play a significant role in delirium. Tryptophan, a serotonin precursor, was reduced in a population of cardiac surgery patients with delirium(Van Der Mast et al,. 2006). Importantly, it appears that an abnormal tryptophan metabolism can modulate the type of delirium: hyperactive or hypoactive (Lewis & Barnett, 2007). Tryptophan, moreover, is tightly connected to melatonin, a hormone involved in the regulation of

circadian rhythm, which has also been linked to delirium. Tryptophan is a direct precursor of melatonin; melatonin is secreted by the pineal gland and metabolized by the liver to 6-hydroxymelatonin and then conjugated with sulphuric acid to 6-sulphatoxymelatonin (excreted in the urine and sometimes used in clinical trials to assess melatonin secretion).

Other possible mechanisms believed to contribute to the occurrence of delirium are acute inflammation and ischemia. The anatomical pathway thought to be involved in delirium includes brain areas such as the thalamus, the prefrontal, posterior parietal and fusiform cortex and the basal ganglia(Van Der Mast et al,. 2006). Hence, in theory, ischemia in one of these areas can lead to delirium. Systemic inflammation has also been implicated in the pathogenesis of delirium. It has been observed that delirious patients after hip replacement surgery had higher serum levels of C-reactive protein (Beloosesky et al., 2004). Other inflammatory cytokines, such as interleukin (IL)-6 and IL-8 are associated with, and can possibly induce, delirium either directly or through a neurotransmitter imbalance (Van Gool et al., 2010).

Methodology

Study Design

This is a Randomized Controlled Trial study, with one experimental group who will receive a delayed daily nursing care and interventions until 6:00am, with no interruption of sleep by any non urgent procedures such as (daily ECG, blood sampling, daily X-rays, linens change...etc), and minimizing exposure to lights and noises by turning unneeded lights off, using eye covers and preventing nursing discussions beside patient`s beds; the control group will receive daily usual care with no manipulations in their environment.

Intervention

The modification of ICU`s environment for the experimental group consists of light reduction by dimming the light in patient`s rooms, and/or above their bed, and offering the patient an eye mask, decreasing noise by liberalizing the unneeded device`s alarms (e.g. ventilators, monitors, and pumps alarms) to the lowest possible level, minimizing conversation near the patient's bedside, delaying daily nursing care to 6:00am, keeping the time from 10:00pm until 6:00am free of sleep interruption as much as possible, taking into consideration that it will not affect the needed patient`s care negatively, delay needed care, or threaten the patient`s life.

Sample and sampling

The sample will be selected by convenience sampling from all intensive care units except pediatric and neonatal units; to control intrinsic factors the selected sample will be divided into two groups by computer program (random assignment), one experimental and another control group.

Including Criteria: All adult patients (above18years), Male and female, who are conscious, oriented, and agree to participate in the study will be included.

Excluding Criteria: All patients less than 18 old, with confirmed brain death by neurology consultant, or fully sedated (who is receiving fentanyl more than 150mcg/h, medazolam more than 3mg/h, or 25mcg/h of propofol and/or narcotic drips of more than10 mg/h for morphine) will be excluded.

Power Analysis

A pilot study will be done to determine the needed sample size, although a previous similar study review indicated that sample size of 50-100 in each group will be suitable.

Settings

ICU (Medical/Surgical), CCU, GIMU, IMCU of all university hospitals in Jordan.

Data collection procedure : by using polysomnogram, which is the most reliable tool for assessing sleep in critically ill patients (Parthasarathy and Tobin, 2004; Pandharipande and Ely, 2006; Drouot et al., 2008), all selected patients, both groups (experimental and control), will be connected to the device all the night (from 10pm to 6am) on their beds; sleep labs technicians will analyze sleep`s waves to determine Total Sleep Time (TST), and Sleep Efficacy for each client.

Ethical Consideration

After the study obtains the IRB committee approval, each patient will sign a consent form before participating in the study; if patient cannot sign, he/she will provide agreement verbally; if patient is unconscious or on mechanical ventilator, the next of kin will sign instead. The goal and possible benefits of the study were discussed with patients;, all questions about the study asked by patients were answered; all participants were informed that they have the choice to withdraw from the study whenever they want without any consequences or change in care level provided for them.

Measurement:

Data analysis plan

Independent researchers not involved in data collection will analyze data. After data is entered into the Statistical Package for Social Science (SPSS 17.0), descriptive statistics such as percentages and frequency counts will be used to summarise data.

References

Beecroft, J.M., Ward, M., Younes, M., et al., Sleep monitoring in the intensive care unit: comparison of nurse assessment, actigraphy and polysomnography. Intensive Care Medicine 2008; 34: 2076-2083.

Beloosesky Y, Grinblat J, Pirotsky A et al. Different C-reactive protein kinetics in post-operative hip-fractured geriatric patients with and without complications. Gerontology 2004; 50: 216-222.

Bonnet, M.H., Arand, D.L. EEG arousal norms by age. Journal of Clinical Sleep Medicine 2007; 3: 271-274.

Bosma, K., Ferreyra, G., Ambrogio, C., et al., 2007. Patient-ventilator interaction and sleep in mechanically ventilated patients: pressure support versus proportional assist ventilation. Critical Care Medicine 35, 1048-1054.

Bourne, R.S., Mills, G.H., Minelli, C. Melatonin therapy to improve nocturnal sleep in critically ill patients: encouraging results from a small randomised controlled trial. Critical Care 2007; 12: R52.

Bourne, R.S., Minelli, C., Mills, G.H., et al. Clinical review: sleep measurement in critical care patients: research and clinical implications. Critical Care 2007; 11: 226.

Cabello, B., Thille, A.W., Drouot, X., et al., 2008. Sleep quality in mechanically ventilated patients: comparison of three ventilatory modes. Critical Care Medicine 36, 1749-1755.

Cochen, V., Arnulf, I., Demeret, S., et al. Vivid dreams, hallucinations, psychosis and REM sleep in Guillain-Barre syndrome. Brain 2005; 128: 2535-2545.

Coyer MF, Wheeler KM, Wetzig MS, Couchman AB. Nursing care of the mechanically ventilated patient: what does the evidence say? Intensive and Critical Care Nursing 2007;23(2):71-80.

de Almeida. Abstracts of 3rd International Congress of the Association of Sleep Medicine (WASM) / Sleep Medicine 10, Suppl. 2 (2009) S1-S83.

Drouot X, Cabello B, d'Ortho MP, Brochard L. Sleep in the intensive care unit. Sleep Medicine Review 2008;5: 391-403.

Eliassen K, Hopstock L. Intensive and Critical Care Nursing 2011; 27: 138-142.

Elliot R, Mckinley S, Cistulli P. International Journal of Nursing Studies 2011; 48: 384-400.

Feeley K, Gardner A. Sedation and analgesia management for mechanically ventilated adults: literature review, case study and recommendations for practice. Australian Critical Care 2006;19(2):73-7.

Ferrie, J.E., Shipley, M.J., Cappuccio, F.P., et al. A prospective study of change in sleep duration: associations with mortality in the Whitehall II cohort. Sleep 2009; 30: 1659-1666.

Friese, R.S., Diaz-Arrastia, R., McBride, D. Quantity and quality of sleep in the surgical intensive care unit: are our patients sleeping? Journal of Trauma 2007; 63: 1210-1214.

Gabor JY, Cooper AB & Hanly PJ. Sleep disruption in the intensive care unit. Curr Opin Crit Care 2001; 7: 21-27.

Gallicchio, L., Kalesan, B. Sleep duration and mortality: a systematic review and meta-analysis. Journal of Sleep Research 2009; 18, 148-158.

Hardin KA. Sleep in the ICU. Potential mechanisms and clinical implications. Chest 2009;136:284-294.

Kass JL. To sleep in an intensive care unit, perchance or heal. Critical Care Medicine 2008;36(3):988-9.

Kryger, M.H., Roth, T., Dement, W.C. Principles and Practice of Sleep Medicine. Philadelphia Elsevier Saunders.

Lewis MC & Barnett SR. Postoperative delirium: the tryptophan dysregulation model. Med Hypotheses 2004; 63: 402-406.

Ohayon, M.M., Carskadon, M.A., Guilleminault, C., et al., 2004. Metaanalysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human lifespan. Sleep 2004: 27; 1255-1273.

Parthasarathy S, Tobin MJ. Sleep in the intensive care unit. Intensive Care Medicine 2004;30:197-206.

Roche Campo, F., Drouot, X., Thille, A.W., et al. Poor sleep quality is associated with late noninvasive ventilation failure in patients with acute hypercapnic respiratory failure. Critical Care Medicine 2010; 38: 477-485.

Temboa A, Parkerb V. Intensive and Critical Care Nursing 2009; 25: 314-322.

Trzepacz PT. Is there a final common neural pathway in delirium? Focus on acetylcholine and dopamine. Semin Clin Neuropsychiatry 2000; 5: 132-148.

Van Der Mast RC, van den Broek WW, Fekkes D et al. Is delirium after cardiac surgery related to plasma amino acids and physical condition? J Neuropsychiatry Clin Neurosci 2006; 12: 57-63.

Van Gool WA, van de Beek D & Eikelenboom P. Systemic infection and delirium: when cytokines and acetylcholine collide. Lancet 2010; 375: 773-775.

Watson P, Fanfulla F. Best Practice & Research Clinical Anaesthesiology 2012; 26: 355-366