ORIGINAL ARTICLE

Observational Study

Sleep quality in middle-aged and elderly hemodialysis patients: Impact of a structured nursing intervention program

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Abstract

BACKGROUND
Poor sleep quality is common among hemodialysis patients and can significantly impact their well-being. This study aimed to evaluate the effectiveness of a structured nursing intervention program in improving sleep quality in middle-aged and elderly hemodialysis patients.

AIM
To evaluate the impact of nursing intervention on sleep quality in hemodialysis patients.

METHODS
This cross-sectional study was conducted in a tertiary hospital, the First Affiliated Hospital of Nanchang University, in 2023. This study included 105 middle-aged and elderly hemodialysis patients aged $\geq$ 45 years who underwent maintenance hemodialysis for at least 3 mo, utilizing the Pittsburgh Sleep Quality Index (PSQI) to identify poor sleepers. Those identified underwent a 12-wk nursing intervention program focusing on education, relaxation techniques, and counseling. Post-intervention, sleep quality was reassessed using the PSQI.

RESULTS
The study found that 68.6% of hemodialysis patients were poor sleepers. Following the 12-wk nursing intervention program, there was a significant decrease in the mean global PSQI score from 8.9 ± 3.2 to 5.1 ± 2.7 ($P < 0.001$), indicating improved sleep quality. This demonstrated the effectiveness of the structured nursing intervention in enhancing sleep quality for middle-aged and elderly hemodialysis patients.

CONCLUSION

The structured nursing intervention program focusing on sleep hygiene education, relaxation techniques, and counseling effectively improved sleep quality among middle-aged and elderly hemodialysis patients. The significant decrease in the mean global PSQI score post-intervention indicates the positive impact of tailored nursing interventions in addressing poor sleep quality in this patient population. These findings emphasize the importance of implementing targeted nursing interventions to enhance the quality of life for hemodialysis patients by addressing the prevalent issue of poor sleep quality.

Key Words: Hemodialysis patients; Nursing intervention; Sleep quality; Elderly; Pittsburgh Sleep Quality Index; Patient well-being

Core Tip: A structured nursing intervention program focusing on education, relaxation techniques, and counseling significantly improved sleep quality in middle-aged and elderly hemodialysis patients. Tailored nursing interventions are crucial in addressing the common issue of poor sleep quality in this patient population, emphasizing the importance of targeted approaches to enhance patient well-being.

INTRODUCTION

Sleep disturbance is highly prevalent among patients with end-stage renal disease (ESRD) who undergo hemodialysis, with estimates suggesting that up to 80% of this population experience poor sleep quality[1,2]. The etiology of sleep problems in patients undergoing hemodialysis is multifactorial and includes physiological, psychological, and treatment-related factors. Addressing these sleep disturbances is of paramount importance, as they can significantly impact overall health, quality of life, and clinical outcomes of patients.

Poor sleep quality has an extensive and multifaceted impact on hemodialysis patients. Chronic sleep deprivation can lead to a weakened immune system, an increased risk of cardiovascular disease, and impaired cognitive functioning[3]. In addition, poor sleep quality has been associated with higher levels of inflammation, which can exacerbate the elevated inflammatory state in patients undergoing hemodialysis[4]. Persistent low-grade inflammation is associated with an increased risk of cardiovascular complications, malnutrition, and mortality in patients with ESRD[5].

Moreover, sleep disturbance can contribute to the development of depression and anxiety disorders, further compromising the overall well-being and quality of life of patients undergoing hemodialysis[6]. Depression and anxiety are highly prevalent in this population, with estimates ranging from 20% to 30% for depression and up to 50% for anxiety disorders[7]. These psychological conditions can negatively affect treatment adherence, self-care behaviors, and overall health outcomes[8].

Furthermore, hemodialysis can interfere with sleep quality. Patients may experience discomfort, cramps, or other symptoms during or after dialysis that may lead to disrupted sleep patterns[9]. Additionally, the timing of dialysis treatments, which often occur during the night or early morning hours, can further disrupt the natural sleep-wake cycle. This disruption can contribute to circadian rhythm disturbances, which are associated with an increased risk of cardiovascular events, cognitive impairment, and mortality in hemodialysis patients[10].

Given the multifactorial nature of sleep disturbance in patients undergoing hemodialysis, a multidisciplinary approach that involves medical, nursing, and psychological interventions is often necessary to address this issue effectively. Pharmacological interventions, such as sleep medications, have been explored; however, their long-term safety and efficacy in this population remain controversial[11]. Moreover, the potential interactions between sleep medications and other medications commonly prescribed to patients on hemodialysis, as well as the risk of adverse effects, should be carefully considered[12].

Nursing interventions, in particular, have shown promise in improving sleep quality in various populations of patients [13]. Non-pharmacological approaches, such as sleep hygiene education, relaxation techniques, and cognitive-behavioral therapy, have been increasingly recognized as effective and safe strategies for managing sleep disturbances[14]. These interventions can be tailored to the specific needs of patients undergoing hemodialysis and integrated into their overall care plans.

Sleep hygiene education aims to promote healthy sleep habits by addressing factors that can interfere with sleep quality, such as irregular sleep-wake schedules, exposure to light and noise before bedtime, and the consumption of stimulants[15]. By providing practical and educational strategies, nurses can empower patients to play an active role in improving sleep quality.

This study aimed to assess sleep quality in this patient population and evaluate the impact of a structured nursing intervention program on sleep quality.

MATERIALS AND METHODS

Study design and participants

This cross-sectional study was conducted in a tertiary hospital, the First Affiliated Hospital of Nanchang University, in 2023. This study included 105 middle-aged and elderly hemodialysis patients aged ≥ 45 years who underwent maintenance hemodialysis for at least 3 mo. Patients with cognitive impairment (mini-mental state examination score < 24), severe mental disorders (such as schizophrenia or bipolar disorder), or unstable medical conditions (such as active malignant tumors or acute cardiovascular events within the past 3 mo) were excluded from the study. The research protocol was approved by the local institutional review committee and written informed consent was obtained from all participants.

Sample size calculation

The sample size was calculated based on the primary outcome measure, the change in the global Pittsburgh Sleep Quality Index (PSQI) score after the nursing intervention program. We assumed a mean difference in the PSQI score of 2.0 (standard deviation = 3.0) between the preintervention and postintervention measurements. With the desired power of 80% and a two-sided significance level of 0.05, the required sample size was estimated to be 90 participants. Anticipating a dropout rate of 15%, at least 105 participants were recruited.

Data collection

Demographic and clinical data, including age, sex, comorbidities (hypertension, diabetes mellitus, cardiovascular disease, and chronic obstructive pulmonary disease), and dialysis vintage (duration of hemodialysis treatment) were collected from participants' medical records by trained research assistants.

Sleep quality was assessed using the PSQI, a validated self-report questionnaire that measures sleep quality and disturbances during the previous month[16]. The PSQI consists of seven components: Subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleep medication use, and daytime dysfunction. The global PSQI score ranges from 0 to 21, with a score greater than 5 indicating poor sleep quality.

In addition to PSQI, participants were asked to complete the Epworth Sleepiness Scale (ESS) to assess daytime sleepiness[17]. The ESS is a self-administered questionnaire that measures the likelihood of dozing off in different situations, with scores ranging from zero to 24. Higher scores indicate greater daytime sleepiness.

Procedure

After giving their informed consent, the participants completed baseline assessments, including PSQI, ESS, and a demographic and clinical information questionnaire. The assessments were conducted in a quiet, private room by trained research assistants who were blinded to the objectives of the study.

For participants identified as poor sleepers (global PSQI score > 5), the nursing intervention program commenced within 2 wk of baseline assessment. The intervention was delivered by a team of four nurses who had received specialized training in sleep hygiene education, relaxation techniques, and specific counseling strategies for hemodialysis patients.

Sleep hygiene education sessions lasted approximately 60 min and were conducted in small groups of 58 participants. During these sessions, nurses provided information on sleep hygiene principles, such as maintaining a consistent sleep-wake schedule, creating a conducive sleep environment, and avoiding stimulants before bedtime. Participants received printed handouts and access to multimedia resources to reinforce concepts.

Relaxation technique sessions were also conducted in small groups and lasted approximately 90 min. During these sessions, nurses introduced and guided participants through deep breathing exercises, progressive muscle relaxation, and guided imagery techniques. Participants were encouraged to practice these techniques at home daily and were provided with audio recordings to facilitate their practice.

Individualized counseling sessions were scheduled every 2 wk and lasted approximately 30-45 min per participant. During these one-on-one sessions, nurses explored each participant's specific sleep-related concerns and potential contributing factors and provided personalized recommendations and support.

No additional interventions beyond usual care were provided to participants who were not identified as poor sleepers at baseline. However, they were invited to complete follow-up assessments at the end of the 12-wk study period.

At the end of the intervention program, all participants completed the PSQI and ESS assessments again and their scores were compared with the baseline measurements. Research assistants who conducted follow-up assessments were blinded to group assignments of participants.

Data analysis

Descriptive statistics are used to summarize the demographic and clinical characteristics of the participants. PSQI global and ESS scores were compared before and after the nursing intervention using paired *t*-tests. Pearson's correlation coefficient was calculated to assess the relationship between PSQI and ESS scores. Statistical significance was set at $P < 0.05$. All statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, United States).

RESULTS

Participant characteristics

The study included 105 participants, with a mean age of 62.4 ± 9.8 years (range: 45-84 years). Most of the participants were male (58.1%), and the most common comorbidities were hypertension (72.4%), diabetes mellitus (48.6%), and cardiovascular disease (36.2%). The mean dialysis vintage (duration of hemodialysis treatment) was 4.2 ± 2.9 years. The demographic and clinical characteristics of the participants are shown in Table 1.

Sleep quality assessment

The initial survey revealed that 72 participants (68.6%) had a global PSQI score greater than 5, indicating poor sleep quality. The mean global PSQI score for the entire sample was 7.8 ± 3.6. The distribution of the PSQI component scores is presented in Table 2. The most frequently reported sleep disturbances included difficulty falling asleep (53.3%), waking up at night or early in the morning (61.9%), and feeling too hot (48.6%). The mean ESS score for the entire sample was 8.2 ± 4.7, with 30 participants (28.6%) scoring above 10, indicating excessive daytime sleepiness.

Effectiveness of a nursing intervention program

Among the 72 participants identified as poor sleepers, 65 completed a 12-wk structured nursing intervention program. After the intervention, the mean global PSQI score significantly decreased from 8.9 ± 3.2 to 5.1 ± 2.7 ($P < 0.001$), indicating improved sleep quality. The percentage of participants classified as poor sleepers (global PSQI score > 5) decreased from 100% to 35.4%. The changes in the PSQI component scores before and after the intervention are presented in Table 3.

Furthermore, the mean ESS score decreased significantly from 10.1 ± 4.2 to 6.8 ± 3.9 ($P < 0.001$), indicating a reduction in daytime sleepiness. The percentage of participants with excessive daytime sleepiness (ESS > 10) decreased from 43.1% to 16.9%.

A moderate positive correlation was found between PSQI and ESS scores before the intervention ($r = 0.49$, $P < 0.001$), suggesting that participants with poor sleep quality were more likely to experience excessive daytime sleepiness.

DISCUSSION

This study highlighted the high prevalence of poor sleep quality and excessive daytime sleepiness among middle-aged and elderly patients undergoing hemodialysis. The structured nursing intervention program implemented in this study, which comprises sleep hygiene education, relaxation techniques, and individualized counseling, effectively improved sleep quality and reduced daytime sleepiness in the patient population.

The high prevalence of poor sleep quality observed in this study is consistent with previous findings in the hemodialysis population[18]. Sleep disturbances in hemodialysis patients can be attributed to various factors, including accumulation of uremic toxins, restless legs syndrome, periodic limb movements, obstructive sleep apnea, and side effects[19]. Furthermore, the dialysis procedure itself can contribute to sleep disturbances, as patients can experience discomfort, cramps, or other symptoms during or after treatment, which can interfere with sleep quality[20].

The significant decrease in the mean global PSQI score and percentage of participants classified as poor sleepers after the intervention suggests that a comprehensive approach that combines sleep hygiene education, relaxation techniques, and individualized counseling can effectively address sleep-related issues in this population of patients.

The sleep hygiene education component of the intervention program aimed to provide participants with practical strategies to promote better sleep habits. Maintaining a consistent sleep-wake schedule, creating a conducive sleep environment, and avoiding stimulants before bedtime are well-established sleep hygiene principles that can help improve sleep quality[21]. By incorporating these principles into their daily routines, participants may have experienced improved sleep-onset latency, reduced nighttime awakenings, and better overall sleep quality.

Relaxation techniques introduced in the program, such as deep breathing exercises, progressive muscle relaxation, and guided imagery, promote relaxation and reduce physiological and psychological arousal, which can facilitate better sleep [22]. These techniques may have helped participants manage stress and anxiety, which are common factors that contribute to sleep disturbances in patients undergoing hemodialysis[23].

Individualized counseling sessions allowed nurses to address each participant's specific sleep-related concerns and tailor the intervention to their unique needs. By exploring potential contributing factors, such as medication side effects, lifestyle habits, or psychological factors, nurses could provide personalized recommendations and support, enhancing the effectiveness of the intervention.

The reduction in daytime sleepiness observed after the nursing intervention is noteworthy. Excessive daytime sleepiness can significantly impair quality of life, cognitive function, and daily activities of hemodialysis patients[24]. The moderate positive correlation between PSQI and ESS scores before the intervention supports the notion that improving sleep quality can lead to a reduction in daytime sleepiness, which is consistent with previous findings[25].

The high prevalence of poor sleep quality observed in this study (68.6%) is consistent with previous findings in the hemodialysis population, although it is slightly lower than the 80% reported in some studies. This discrepancy may be attributed to differences in sample characteristics, assessment tools, and the specific population studied. Future research should aim to clarify the factors contributing to the variation in prevalence rates of poor sleep quality among hemodialysis patients.

Table 1 Demographic and clinical characteristics of the participants (*n* = 105)

Characteristic	Value
Age (years), mean ± SD	62.4 ± 9.8
Sex, *n* (%)	
Male	61 (58.1)
Female	44 (41.9)
Comorbidities, *n* (%)	
Hypertension	76 (72.4)
Diabetes mellitus	51 (48.6)
Cardiovascular disease	38 (36.2)
Chronic obstructive pulmonary disease	12 (11.4)
Dialysis vintage (years), mean ± SD	4.2 ± 2.9

Table 2 Distribution of Pittsburgh Sleep Quality Index component scores at baseline (*n* = 105)

PSQI component	mean ± SD	Score > 2, *n* (%)
Subjective sleep quality	1.6 ± 0.8	59 (56.2)
Sleep latency	1.8 ± 1.1	56 (53.3)
Sleep duration	1.2 ± 1.0	33 (31.4)
Habitual sleep efficiency	1.1 ± 1.2	36 (34.3)
Sleep disturbances	1.6 ± 0.7	65 (61.9)
Use of sleeping medication	0.5 ± 1.0	18 (17.1)
Daytime dysfunction	1.1 ± 0.9	43 (41.0)

PSQI: Pittsburgh Sleep Quality Index.

Table 3 Changes in Pittsburgh Sleep Quality Index component scores before and after the nursing intervention program (*n* = 65)

PSQI component	Baseline	Post-intervention	*P* value
Subjective sleep quality	1.9 ± 0.7	1.1 ± 0.7	< 0.001
Sleep latency	2.1 ± 1.0	1.2 ± 0.9	< 0.001
Sleep duration	1.4 ± 1.0	0.8 ± 0.9	< 0.001
Habitual sleep efficiency	1.5 ± 1.2	0.6 ± 0.9	< 0.001
Sleep disturbances	1.8 ± 0.6	1.1 ± 0.6	< 0.001
Use of sleeping medication	0.7 ± 1.1	0.3 ± 0.7	0.002
Daytime dysfunction	1.4 ± 0.8	0.7 ± 0.7	< 0.001

Data are presented as the mean ± SD. PSQI: Pittsburgh Sleep Quality Index.

It is important to note that while sleep disorders can contribute to the development of depression and anxiety, this study did not specifically assess the psychological status of participants or the impact of the nursing intervention on their psychological well-being. Future research should investigate the relationship between sleep disorders, psychological status, and the effectiveness of nursing interventions in addressing these issues in hemodialysis patients.

The strengths of this study include the use of validated assessment tools (PSQI and ESS), implementation of a comprehensive nursing intervention program tailored to the specific needs of middle-aged and elderly patients undergoing hemodialysis, and rigorous training provided to the nursing staff involved in delivering the intervention. However, this study has some limitations, including the lack of a control group, the potential for self-reporting bias in the assessment tools, and the relatively short duration of the intervention. Additionally, this study did not investigate the long-term

effects of nursing interventions on sleep quality and daytime sleepiness, which warrants further research.

CONCLUSION

This study highlighted the high prevalence of poor sleep quality and excessive daytime sleepiness among middle-aged and elderly patients undergoing hemodialysis. The structured nursing intervention program implemented in this study, which comprises sleep hygiene education, relaxation techniques, and individualized counseling, effectively improved sleep quality and reduced daytime sleepiness in the patient population. These findings underscore the importance of addressing sleep disturbance in hemodialysis patients and the potential benefits of targeted nursing interventions. Future research should focus on exploring the long-term effects of such interventions and investigating the underlying mechanisms that contribute to improved sleep quality. In addition, integrating objective sleep measurement methods, such as actigraphy or polysomnography, could provide more comprehensive information on sleep patterns and quality in patients undergoing hemodialysis. Furthermore, the development and implementation of standardized nursing protocols and guidelines to address sleep disturbance in hemodialysis patients could facilitate consistent and effective care in healthcare settings. A multidisciplinary collaboration that involves nephrologists, sleep specialists, psychologists, and nursing staff can further enhance the management of sleep-related issues in this vulnerable patient population.

FOOTNOTES

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