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Can A Nursing Intervention Improve the Sleep Pattern Disorders in Patients Undergoing Hemodialysis in Morning and Afternoon Shifts?

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Introduction

End-stage renal disease (ESRD) is associated with an increased prevalence of sleep disturbances, which have a major influence on vitality and general health of hemodialysis patients [1]. On average, 50-80% of these patients suffer from delayed sleep onset and have trouble staying asleep [2,3]. A recent study carried out at Zagazig and Ain-Shams University Hospitals in Egypt revealed that more than half (56.7%) of patients undergoing hemodialysis had sleep disturbances [4]. Sleep disorders such as restless legs, periodic limb movements, sleep apnea, and sleep complaints such as insomnia and day time sleepiness are very common despite treatment with hemodialysis [5]. Such disorders affect the quality of life (QOL) with serious socioeconomic implications [6,7], and they may increase cardiovascular morbidity and mortality [8], with a higher risk of all-cause mortality [9].

Sleep disorders have emerged as an important health hazard and some of the factors involved in the pathogenesis of renal disease are the same that cause or are associated with sleep apnea [10]. The factors contributing to sleep disturbances in patients on dialysis have been classified as treatment-related (e.g. premature discontinuation of dialysis, rapid changes in fluid and electrolyte and acid base balance, alteration in medications, dialysis shift); psychological (e.g. anxiety, depression, stress, and worry); disease-related (e.g. co-morbid conditions, anaemia, uraemia and metabolic changes); lifestyle-related (e.g. excess coffee, smoking, poor sleep hygiene); and demographic factors (e.g. older age, gender, race) [1,11] . Nonetheless, the increase in the prevalence of sleep disorders in ESRD patients has been attributed to potential patient selection bias and comorbid conditions such as cardiovascular disease, diabetes mellitus, obesity and older age [12].

Healthcare has traditionally focused on diagnosing and treating physical signs and symptoms. However, it is now recognized that the physical, psychological and social aspects of a patient's life are important issues to consider when caring for people with chronic illnesses such as ESRD with sleep disturbances. Nurses play an important role in this aspect through providing optimal dialysis, a supportive environment and comprehensive and continuous education, ensuring holistic care [13,14]. However, studies about the role of nurses' intervention on sleep abnormalities in patients on hemodialysis taking various influencing factors into account are still under the study.

Aim of the Study

The aim of this study was assess the effectiveness of nursing intervention guidelines in improving sleep pattern and quality in ESRD patients undergoing hemodialysis in morning and afternoon shift. The research hypothesis was that the nursing intervention guidelines based on identified factors underlying the sleep disorders among ESRD patients undergoing hemodialysis will improve their sleep pattern and quality in morning shift and afternoon shift.

Subjects and Methods

Research Design and Setting

A controlled quasi-experimental design with pre-post-follow-up assessment was used in this study. Participating patients were assessed at three time intervals: before, at completion, and 12 weeks after completion of the health guidance nursing intervention. The study was conducted at the Nephrology Hemodialysis Units at the Zagazig University Hospital.

Participants

The study population consisted of all patients undergoing chronic hemodialysis in the study setting. The inclusion criteria were age 18-75 years, having hemodialysis sessions at the same hour of the day, either in the morning (6:30 to 10:30 AM) or afternoon (3:30 to 7:30 PM) sessions, for at least three months. The exclusion criteria were having cancer, severe neurological, hepatic, lung or cardiac diseases, or recent infections. The sample size was calculated to a difference of at least 1 hour night sleep between the morning and afternoon sessions' patients with a standard deviation 1 hour at 95% level of confidence and 90% power. This required 23 patients per group, which was increased to 30 patients per group to account for dropouts. Patients were consecutively recruited from the study population according to eligibility criteria to either the morning or afternoon groups.

Data Collection Tools

The researchers developed an interview questionnaire to collect data regarding patient's socio-demographic characteristics, physical health problems, psychosocial factors and feeling, in addition to Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS). The patient's blood pressure and height and weight were recorded, and the Body Mass Index (BMI) calculated, measurements of serum creatinine, hemoglobin, calcium, hematocrit, urea and

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phosphates as a biochemical factors. The biochemical data were collected from patients' files.

In the physical health problems section, the patient was asked about the presence of symptoms related to various body systems such as cough, apnea, and shortness of breath in the respiratory system, and cramps and joint pains in the musculoskeletal system. Each symptom reported to be present was scored 1, and the total sum was counted as the total number of symptoms.

The patient's perception of the psychosocial factors was assessed using a 4-point Likert scale type measuring the social factors such as "sleeping alone in room" and "troubled by others during sleep", breathing while sleeping such as "snoring" and "having problem sleeping on the back", psychosomatic state such as "anxiety" and "fatigue", and patient feelings such as "feeling scared" and "feeling fatigue with no energy." The scale from "never" to "always" was scored 1 to 4 so that a higher score indicates more trouble with the psychosocial factors. The scores of the items were summed-up and the total divided by the number of the items, giving a mean score; means and standard deviations and medians were computed [1,4,11,15].

Sleep quality was assessed using the PSQI. This scale has seven components namely subjective quality of sleep; sleep onset latency; sleep duration; sleep efficiency; presence of sleep disturbances; use of hypnotic-sedative medication; and presence of daytime disturbances, as an indication of daytime alertness [16]. Individuals with total PSQI score of six or more are considered poor sleepers [17]. In addition, the patient was asked to subjectively judge whether the sleep hours were sufficient or not.

Daytime sleepiness was assessed by the Epworth Sleepiness Scale (ESS) [18]. This is a validated 8-item questionnaire inquiring about respondent's expectation of dozing in eight hypothetical situations such as sitting and reading, watching TV, sitting inactive in a public place, as a passenger in a car for 1 hour without a break, lying down in the afternoon when circumstances permit, sitting and talking to someone, sitting quietly after lunch, and in a car while stopped for a few minutes in traffic. Dozing probability ratings range from zero (no probability) to three (high probability). A total score of 10 or more indicates excessive daytime somnolence [6].

Study Manoeuvre

The study was achieved through preparatory, assessment, planning, implementation, and evaluation phases.

Preparatory Phase and Pilot Study

The researchers prepared the data collection tools and the health guidance educational nursing intervention based on pertinent literature. The interview questionnaire was face and content-validated by five experts from medical-surgical nursing and two from the nephrology department in the Faculty of Medicine. A pilot study was conducted in June 2012 on six ESRD patients from the study setting to assess the practicability of the tools and the reliability of their scales. Based on the findings of the pilot study, the necessary modifications were done. The pilot sample was included in the nursing intervention but not in data analyses. The reliability of the ESS and psychosocial scales turned to be high with Cronbach's alpha coefficients 0.80 and 0.96 respectively.

Assessment

Upon getting their informed consents, eligible participants were alternatively assigned to either the morning or afternoon groups, ending with 30 patients in each group. The morning group patients received the structured nursing intervention during and after hemodialysis in the morning, whereas the afternoon group received the same intervention before and during hemodialysis in the afternoon. The socio-demographic and clinical data were obtained by the researchers through interviewing using the developed questionnaire. The biochemical data were collected from patients' files; they included measurements of serum creatinine, hemoglobin, calcium, hematocrit, urea and phosphates. All variables were measured concurrently. The baseline data collection lasted from June to the end of July 2012. This was done three days per week from 8.30 AM to 10.30 AM for morning group and from 3.00 PM to 5.00 PM for afternoon group. Each interview took from 30 to 40 minutes.

Planning

Based on assessment data and related literature, the researchers prepared an educational intervention guidelines to help improving patients' sleep, with a booklet in Arabic language to be administered by the end of the sessions. This non-pharmacological nursing intervention included daytime physical activity with attempts to keep subjects out of bed, with afternoon bright light exposure, a consistent bedtime routine, night time care routines to minimize sleep apnea and disruption, in addition to strategies to reduce night time noise. The most common behavioral treatments used were sleep hygiene, sleep restriction, stimulus control, and relaxation training which are combined for optimal success [19].

- Sleep hygiene is used to improve sleep onset and maintain continuous sleep; it is most effective when combined with other behavioral therapies. The patient is advised to do avoid caffeinated beverages and nicotine for at least six hours before bedtime, avoid alcohol, exercise regularly but not for at least three hours prior to bedtime, avoid naps if having trouble falling asleep at night, establish a regular routine for bedtime and morning awakening, even on weekends, use the bed only for sleep or sex, but avoid reading or watching television, get out of bed and engage in some relaxing activity if one cannot fall asleep after lying in bed for 30 minutes and return to bed only when one feels sleepy, eliminate clocks in the bedroom, eat meals regularly and do not go to bed hungry or full stomach, and try not to take one's problems to bed.
- Sleep restriction is a temporary treatment based on the notion that sleep deprivation leads to consolidation of sleep. To increase sleep efficiency to about 90% the patient is instructed to restrict time in bed to achieve some degree of sleep deprivation, not spend more than 15 minutes awake either at the beginning of sleep or after getting up, avoid activities at bedtime, get out of bed at predetermined time no matter how little sleep was, and use medications as prescribed.
- Stimulus control therapy is based on the assumption that the patient views the bedroom as a place where sleep cannot be obtained. Hence, the patient is instructed to change behavior so that the bedroom and bed is associated strictly with sleep. The patient is to get out of bed if he/she cannot fall asleep after 10-15 minutes. However, the clock should not be watched as this behavior may condition sleeplessness. Once up, the patient is to go to another room and engage in activity that is relaxing. When sleepy, he/she should return to bed.

- **Relaxation training** may be helpful in patients who are apneic, anxious, or tend to bring their problems to bed. It uses biofeedback techniques or other maneuvers to reduce musculoskeletal tension, best performed before sleep. They include calm breathing, relaxation exercises, and relaxation training with listening to music.

Implementation

The application of the guidelines by the researchers lasted for 6 months from the beginning of August to the end of January 2013. The researchers pre-determined appointments with the patients through phone calls. The session took approximately between 30 to 40 minutes to complete it. The nursing intervention guideline was designed as booklet, poster, data show and CD films. It was administered through individual sessions. The total number of sessions was nine: three theoretical and six practical. The theoretical sessions covered 1) knowledge about hemodialysis, and its effect on the body system; 2) definition of sleep disorders, factors affecting on sleep pattern for hemodialysis patients (physical, psychological, social and spiritual); 3) behavioral management for sleep disorders (sleep hygiene, sleep restriction, stimulus control and physical problem). As for the practical sessions, the first two covered physical support through nursing intervention for health problems reported by the patient, the 3rd to 5th involved the physiological coping strategies through relaxation training, deep breathing technique, meditation, and exercises, and the 6th session covered psychosocial support.

At the beginning of the first session, an orientation to the intervention guideline and its purpose was presented. Each session started by a summary about what had been given through the previous session and the objectives of the new one, taking into consideration the use of simple language to suit the educational level of the patient. Discussions, motivation and reinforcement were used to enhance learning. Direct reinforcement in the form of a copy of health guideline for nursing intervention was offered for each patient to use it as future reference.

Evaluation

The effect of the nursing intervention on sleep pattern disorders was assessed immediately post-intervention and after 3 months using the same data collection tools of the pre-intervention assessment.

Ethical Considerations

The study protocol was approved by the local Research Ethics Committee. Necessary approvals from the settings' administration were obtained in order to carry out the study. The researchers briefed participants with the purpose and nature of the study and the educational nursing intervention, and their informed consents were secured. They were reassured about confidentiality and about their rights to refuse or withdraw at any time. The study maneuvers could not have any foreseen harmful effects on participants.

Statistical Analysis

Data entry and statistical analysis were done using SPSS 18.0 statistical software package. Cronbach alpha coefficient was calculated to assess the reliability of the developed tools through their internal consistency. Quantitative continuous data were compared using the non-parametric Mann-Whitney or Kruskal-Wallis tests. Categorical variables were compared using chi-square test. Whenever the expected values in one or more of the cells in a 2x2 tables was less than 5, Fisher exact test was used instead. In larger than 2x2 cross-tables, no test could be applied whenever the expected value in 10% or more of the cells was less than 5. In order to identify the independent predictors of the number of sleep hours and the sleep quality score, multiple linear regression analysis was used after testing for normality, and homoscedasticity, and analysis of variance for the full regression models were done. Statistical significance was considered at p-value <0.05.

Results

The patients in the morning and afternoon groups had similar socio-demographic characteristics as indicated in Table 1. They were mostly males, married, with no formal education, employed, living with the family, and with close median ages of 54.5 and 57.0 years respectively. Slightly more than half of both groups had rural residence, 56.7% and 60.0 % respectively, and sufficient income, 56.7% for both groups. The median duration of illness was slightly longer in the morning group (3 years) compared with the afternoon group (2 years), but the difference was not statistically significant (p=0.09). The majority of the patients in both groups were overweight or obese, 76.7% and 83.3%, respectively.

	Group				**X2 test**	**p-value**
	Morning (n=30)		**Afternoon (n=30)**			
	No.	**%**	**No.**	**%**		
Age:						
<60	25	83.3	21	70		
60+	5	16.7	9	30	1.49	0.22
Range	27.0-75.0		45.0-76.0			
Mean ± SD	53.6 ± 8.9		57.2 ± 7.0			
Median	54.5		57			
Gender:						
Male	18	60	21	70		
Female	12	40	9	30	0.66	0.42
Marital status:						
Unmarried	7	23.3	9	30		
Married	23	76.7	21	70	0.34	0.56
Formal education:						
No	22	73.3	18	60		
Yes	8	26.7	12	40	1.2	0.27
Job status:						
Unemployed/ housewife	10	33.3	7	23.3		
Working	20	66.7	23	76.7	0.74	0.39

Live with:						
Family	25	83.3	21	70		
Alone	5	16.7	9	30	1.49	0.22
Residence:						
Rural	17	56.7	18	60		
Urban	13	43.3	12	40	0.07	0.79
Income:						
Sufficient	17	56.7	17	56.7		
Insufficient	13	43.3	13	43.3	0	1
Duration of illness (years):						
<3	10	33.3	16	53.3		
3+	20	66.7	14	46.7		
Range	1.0-20.0		<1-7.0			
Mean ± SD	3.7±3.6		2.5±1.8		2.94	0.09
Median	3		2			
Obesity (BMI):						
Normal	7	23.3	5	16.7		
Overweight/obese	23	76.7	25	83.3	0.42	0.52

Table 1: Socio-demographic characteristics of patients in the morning and afternoon groups

As Table 2 illustrates, the most commonly reported problems reported by patients before the intervention in both groups were cough, apnea, tachycardia and chest pain, numbness/tingling and difficult concentration, bone/joint pains, itching, and irritability and dependence in the activities of daily living. It is noticed that patients in the morning group had significantly higher prevalence of apnea, difficult concentration, and bone/joint pain, and lower prevalence of shortness of breath, headache, fatigue, and cramps. Their median of total number of reported problems was lower compared with the afternoon group, 15 versus 16 problems respectively, p=0.006.

Problems	Group				X2 test	p-value
	Morning		Afternoon			
	(n=30)		(n=30)			
	No.	%	No.	%		
Respiratory:						
Cough	27	90	28	93.3	Fisher	1
Apnea	26	86.7	19	63.3	4.36	0.04*
Shortness of breath	6	20	19	63.3	11.59	0.001*
Circulatory:						
Tachycardia	29	96.7	29	96.7	Fisher	1
Chest pain	24	80	26	86.7	0.48	0.49
GIT:						
Dry mouth	3	10	9	30	3.75	0.053
Diarrhea	0	0	0	0	0	1
Neurological:						
Numbness/tingling	29	96.7	26	86.7	Fisher	0.35
Trouble sleep	7	23.3	10	33.3	0.74	0.39
Headache	3	10	17	56.7	14.7	<0.001*
Difficult concentration	28	93.3	19	63.3	7.95	0.005*
Fatigue	4	13.3	17	56.7	12.38	<0.001*
Musculoskeletal:						
Cramps	1	3.3	12	40	11.88	0.001*
Bone/joint pain	30	100	24	80	Fisher	0.02*
Integumentary:						
Itching	30	100	28	93.3	Fisher	0.49
Psychological:						
Worry	2	6.7	6	20	Fisher	0.25
Irritability	29	96.7	28	93.3	Fisher	1
Nervousness	21	70	18	60	0.66	0.42
Dependence in ADL	15	50	18	60	0.61	0.44
Total physical problems:						
Range	17-Nov		19-Nov			
Mean ± SD	14.2 ± 2.0		16.1±2.5		U=7.55	0.006*
Median	15		16			

Table 2: Problems reported by patients in the morning and afternoon groups before the intervention (*) Statistically significant at p<0.05, (--) Test result not valid, (U) Mann Whitney test, (ADL) Activities of Daily Living

Table 3 illustrates similar sleep patterns among patients in the morning and afternoon groups before the intervention, with all patients having poor quality sleep, with a median of 4 hours night sleep in both groups, and no statistically significant differences. As regards the factors affecting sleep, it is noticed that the mean scores of social and patient feelings factors were statistically significantly higher among patients in the morning group, whereas those in the afternoon group had higher mean score of breathing while sleeping. Nonetheless, the differences in the medians were trivial, and no statistically significant difference was revealed between the two groups in the total factors score.

	Group		Mann	p-value
	Morning	Afternoon	Whitney	

	(n=30)		(n=30)		test	
	No.	%	No.	%		
Sleep hours:						
Range	2.0-5.0		2.0-5.0			
Mean ± SD	3.7 ± 0.6		3.6 ± 0.6		U=0.95	0.33
Median	4		4			
Sleep hours sufficient:	0	0	0	0	--	--
Daytime sleepiness score (ESS):						
Range	0.0-1.0		0.0-2.0			
Mean ± SD	0.0 ± 0.2		0.1 ± 0.4		0	0.98
Median	0		0			
Sleep quality score (PSQI):						
Poor	30	100	30	100		
Fair	0	0	0	0		
Range	7.0-7.0		6.0-7.0			
Mean ± SD	7.0 ± 0.0		7.0 ± 0.2		1	0.32
Median	7		7			
Regular sleep during session	0	0	0	0	0	1
Total abnormal physical signs						
Range	11.0-17.0		11.0-21.0		U=7.55	0.006*
Mean ± SD	14.2 ± 2.0		16.1 ± 2.5			
Median	15		16			
Social factors (max=4):						
Range	2.7-2.7		2.0-2.7			
Mean ± SD	2.7 ± 0.0		2.5 ± 0.2		9.022	0.003*
Median	2.7		2.7			
Breathing while sleeping (max=4):						
Range	3.8-3.8		3.6-4.0			
Mean ± SD	3.8 ± 0.0		3.9 ± 0.1		21.992	<0.001*
Median	3.8		3.95			
Psychosomatic state (max=4):						
Range	4.0-4.0		4.0-4.0			
Mean ± SD	4.0 ± 0.0		4.0 ± 0.0		--	--
Median	4		4			
Patient feelings (max=4):						
Range	4.0-4.0		3.8-4.0			
Mean ± SD	4.0 ± 0.0		3.9 ± 0.1		10.412	0.001*
Median	4		4			
Total factors (max=4):						
Range	3.6-3.6		3.4-3.7			
Mean ± SD	3.6 ± 0.0		3.6 ± 0.1		0.158	0.691
Median	3.6		3.6			

Table 3: Pre-intervention sleep patterns and related factors among patients in the morning and afternoon groups, (*) Statistically significant at p<0.05, (--) Test result not valid

Concerning the effects of the intervention, Table 4 demonstrates statistically significant improvements in all sleep parameters and the associated physical problems and psychosocial factors in both the morning and afternoon groups. The only exception was regarding the sleep hours, which did not demonstrate statistically significant changes in the afternoon group. Meanwhile, the median sleep hours in the morning group rose from 4 to 6 hours throughout the intervention (p<0.001).

	Pre		Post		FU		Kruskal Wallis Test	p-value
	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median		
Morning:								
Sleep hrs	3.7 ± 0.6	4	5.4 ± 0.9	6	6.2 ± 0.8	6	60.73	<0.001*
Sleepiness score (ESS)	0.0 ± 0.2	0	3.1 ± 2.4	3	4.5 ± 2.7	4	51.73	<0.001*
Sleep quality (PSQI)	7.0 ± 0.0	7	2.6 ± 0.9	2	2.5 ± 1.2	2	65.68	<0.001*
Total physical problems	14.2 ± 2.0	15	6.2 ± 3.6	6	2.7 ± 2.2	2	66.64	<0.001*

Total spiritual feeling	4.0 ± 0.0	4	3.3 ± 0.0	3	3.3 ± 0.0	3	62.87	<0.001*
Total psychosocial factors	3.6 ± 0.0	3.6	1.3 ± 0.2	1.3	1.3 ± 0.2	1.2	64.88	<0.001*
Afternoon:								
Sleep hrs	3.6 ± 0.6	4	3.6 ± 0.6	4	3.6 ± 0.6	4	0	1
Sleepiness score (ESS)	0.1 ± 0.4	0	7.7 ± 3.6	8	9.5 ± 4.2	12	56.09	<0.001*
Sleep quality (PSQI)	7.0 ± 0.2	7	1.9 ± 0.3	2	1.9 ± 0.3	2	81.78	<0.001*
Total physical problems	16.1 ± 2.5	16	7.9 ± 2.8	8	4.8 ± 3.5	3.5	64.49	<0.001*
Total spiritual feeling	3.9 ± 0.1	4	3.3 ± 0.0	3	3.2 ± 0.0	3	62.45	<0.001*
Total psychosocial factors	3.6 ± 0.1	3.6	1.2 ± 0.1	1.2	1.2 ± 0.1	1.2	78.62	<0.001*

Table 4: Scores of sleep pattern and quality and perception of factors affecting sleep among patients in the morning and afternoon groups throughout the intervention, (*) Statistically significant at $p<0.05$

As for the laboratory results, Figures 1 to 3 demonstrate statistically significant trends of improvement of the levels of hemoglobin, serum calcium, and blood urea in both groups throughout the intervention. It is noticed that the levels of hemoglobin and calcium were higher in the afternoon group while the level of urea was lower among them, with statistically significant differences.

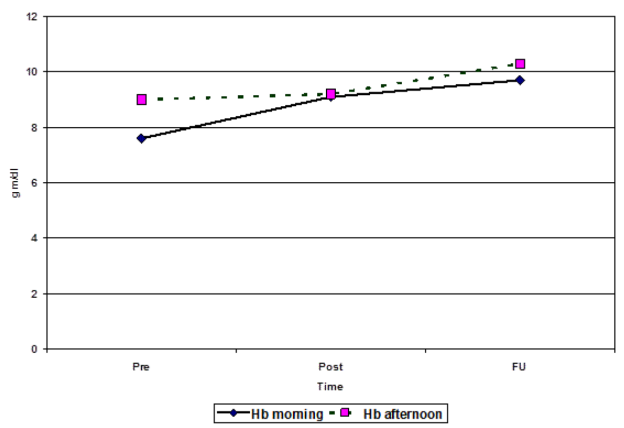

Figure 1: Statistically significant at p<0.05: 1) Time trend in both groups 2) Between groups at FU, Laboratory Hb results of patients in the study and control groups throughout the intervention

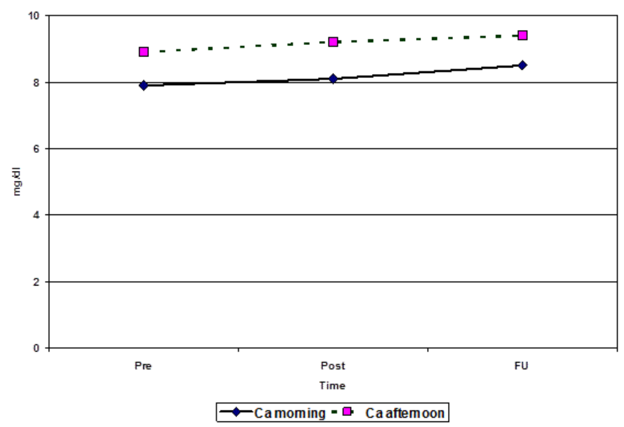

Figure 2: Statistically significant at p<0.05: 1) Time trend in morning group 2) Between groups at all stages, Laboratory Ca results of patients in the study and control groups throughout the intervention

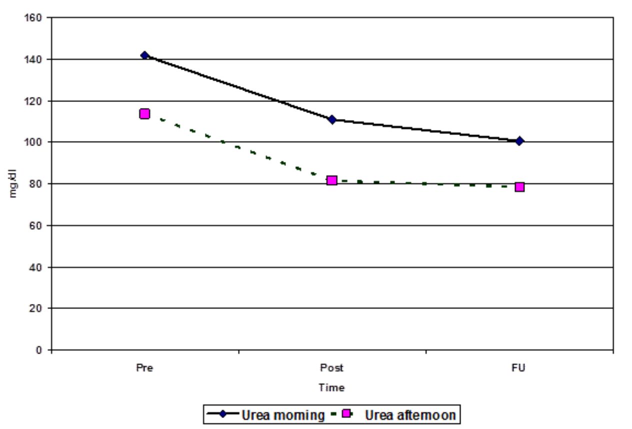

Figure 3: Statistically significant at p<0.05: 1) Time trend in both groups 2) Between groups at all post and FU, Laboratory Blood Urea results of patients in the study and control groups throughout the intervention

Table 5 displays the best fitting multiple linear regression models for the number of sleep hours and its quality throughout the study phases. It shows that being in the afternoon group, having more reported problems, and having a higher score of patient feelings factor were the statistically significant independent negative predictors of the number of sleep hours. The model r-square indicates that these factors explain 56% of the improvement in the number of sleep hours. Meanwhile, other variables such as blood pressure, BMI, hemoglobin and urea, as well as the scores of factors had no significant influence on the sleep hours.

	Unstandardized		Standardized	t-test	p-value	95% Confidence	
	Coefficients		Coefficients			Interval for B	
	B	Std. Error		Low er		Upper	
Sleep hours							
Constant	7.56	0.27		28.08	<0.001	7.03	8.09
Group (reference: morning)	-1.29	0.14	-0.52	-9.46	<0.001	-1.56	-1.02
No. of abnormal signs	-0.08	0.02	-0.36	-4.06	<0.001	-0.12	-0.04
Patient feelings score	-0.37	0.14	-0.3	-2.62	0.01	-0.65	-0.09
r-square=0.56, Model ANOVA: F=56.85, p<0.001							
Variables entered and excluded: scores of factors (social, psychosomatic, breathing while sleeping) blood pressure, BMI, hemoglobin, urea							
PSQI score							
Constant	0.82	0.11		7.34	<0.001	0.6	1.04
Patient feelings score	-0.46	0.08	-0.2	-5.84	<0.001	-0.62	-0.31
Psychsomatic score	0.82	0.17	0.48	4.87	<0.001	0.49	1.15
Breathing while sleeping score	0.7	0.17	0.39	4.27	<0.001	0.38	1.03
Social score	0.76	0.19	0.3	4.07	<0.001	0.39	1.13
r-square=0.98, Model ANOVA: F=1826.89, p<0.001							
Variables entered and excluded: group, number of abnormal signs, blood pressure, BMI, hemoglobin, urea							

Table 5: Best fitting multiple linear regression model for the change in the number of sleep hours and PSQI throughout intervention

As regards the sleep quality score, the same table shows that the all four factors' scores (feelings, psychosomatic, breathing while sleeping, and social) were the statistically significant independent predictors of this score. The patient feelings score was the only negative predictor, while all other three factors were positive predictors. The model explains 98% of the improvement in sleep quality score as indicated by the value of r-square. Meanwhile, the group, number of abnormal signs, blood pressure, BMI, and the levels of hemoglobin and urea had no significant influence on the sleep quality score.

Discussion

Sleep disorder is a common problem in end-stage renal disease (ESRD). This study was carried out to test the hypothesis that a nursing intervention guidelines based on the identified factors affecting sleep pattern will improve the sleep pattern and quality of ESRD patients undergoing hemodialysis in morning shift and afternoon shifts. The study findings lead to acceptance of the research hypothesis although the effect was more evident in the morning sessions group.

The patients in the morning and afternoon sessions in the present study were similar in their socio-demographic characteristics. This was essential since these characteristics may influence their sleep patterns and quality as pointed out by [20] who examined the role of dialysis shift on sleep disturbances in patients on maintenance hemodialysis patient characteristics according to time of dialysis are depicted in three shift groups did not differ with respect to age, gender, marital status, education, Job status, residence, duration of illness, income, BMI, and presence of snoring.

The current study patients also had similarly high frequencies of reported health problems that may have a negative impact on their sleep such as cough, apnea, tachypnea, tingling and numbness, bone aches, and irritability. Although the afternoon group had a significantly higher frequency of these problems, the medians were very high and very close between the two groups. Most of these symptoms may be attributed to the uremic state which affects all body systems as pointed out by [21,22]. Furthermore, Taha [4] found a high prevalence of dependence in the activities of daily living among ESRD patients on hemodialysis, which reflected the high frequency of physical health problems among them. Moreover, the majority of the patients of the current study were overweight or obese, which may increase their risk of getting sleep apnea [23].

The morning and afternoon groups of patients in the present study also had similar baseline numbers of sleep hours, as well as the scores of sleep quality and daytime sleepiness. Their mean PSQI score (7.0) is very close to that reported by Trbojević-Stanković [24] in a study of depression and quality of sleep in maintenance hemodialysis patients where the mean PSQI was 7.8. Moreover, all of our patients had poor quality and insufficient hours before the intervention. In congruence with this, Al-Jahdali [25] mentioned that the prevalence of sleep disorders is much higher than among long-term dialysis patients compared with the general population. The similarity between the current study groups was of major importance in order to be able to assess the effect of the time of the session on the sleep pattern and quality. The lack of a difference in sleep between the morning and afternoon shift is in agreement with the finding of Bastos [26] who found that poor quality of sleep, sleep disorder and sleep abnormalities did not differ between subjects according to dialysis shifts.

The present study has also assessed the various psychosocial factors that may influence the sleep of ESRD patients undergoing dialysis. At the pre-intervention phase, patients in both groups had similarly high scores in all four groups of factors, particularly those related to their psychosomatic state, where all patients in both groups had the maximum score of 4. This is in agreement with previous studies which reported poor physical, psychological, and social health among patients undergoing hemodialysis [27-29].

According to the present study results, the nursing intervention led to significant improvements in sleep quality and daytime sleepiness among the patients in both morning and afternoon shifts. However, the intervention was effective in increasing the sleeping hours of the morning shift patients only. This was further confirmed by multivariate analysis which identified the afternoon shift as a negative predictor of the number of sleep hours. This might be explained by the fact that the morning group may have a better chance and more time to prepare for a good night sleep compared with those in the afternoon shift who may not have an equal chance of doing this. This is particularly important given that more than half of the patients were from rural areas, which means that they may travel back home after the session, reaching homes late in the evening, and not having the opportunity to apply what they have learnt from the intervention guidelines. The finding is in agreement with Wang [30] whose study showed better sleep quality in morning dialysis shift after adjusting for other confounders.

The success of the current study intervention in improving patients' sleep quality seems to have been achieved through acting on their psychosocial related factors. This has been shown by the improvement of their scores in these factors throughout the intervention, and by the multivariate analysis which identified the independent effect of these factors on the PSQI score. In congruence with this finding regarding the effect of psychosocial factors on sleep, Lasch [31] mentioned that the physical, mental, emotional and social health may impair sleep in ESRD patients. However, other factors to be considered are the treatment-related factors, abnormalities in melatonin, alteration in thermoregulatory mechanisms, and co-morbidities [1,11].

Meanwhile, although the biochemical parameters demonstrated significant improvements in both groups throughout the intervention, none of them had an independent significant influence on patients' sleep hours or pattern. The effect of these parameters on sleep is still debatable, with some studies - agreeing with our findings - denying such relation [23,32], while other studies confirmed it [33,34]. Meanwhile, Khalil [35] in an Egyptian study found that and the levels of urea and creatinine might increase the incidence of sleep disorders in ESRD patients who are not maintained on hemodialysis. This issue needs further studies.

Conclusion and Recommendations

In conclusion, nursing intervention guidelines based on identified factors affecting sleep disorders can improve the sleep pattern and quality of the patients with ESRD on hemodialysis through acting on their physical, psychosocial factors and patient feelings. However, it seems to be more effective among patients having morning dialysis sessions compared with afternoon ones. Therefore, it is essential that the nurses identify the factors that may adversely affect the quality of sleep of these patients and develop strategies to reduce their sleep disorders. The findings should be further confirmed through randomized clinical trials to avoid the limitations of confounding factors. The effect of biochemical parameters on sleep quality and pattern needs further investigation.

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