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Quality of Sleep in Predialysis Patients with Chronic Kidney Disease

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Abstract

The purpose of this study were to measure the prevalence of sleep disturbance in a prevalent population of chronic kidney disease (CKD) patients and to examine the association between quality of sleep and the other variables in this population. The subjects of the study were 126 patients who visited the nephrology outpatient department of a tertiary hospital in Seoul between December 12th and December 23th, 2012 and consented to participate in the study. Descriptive were used to analyze the data with the SPSS Win 12.0 program. Sleep disorder was identified in 42.9% of the participants. Quality of sleep level showed a maximum score of 80 with a mean score of 48.6. There was a significant difference in the quality of sleep of the subjects at each stage(F=10.94, p=<.001). The Scheffe post hoc test confirmed that patients at higher stages had lower levels of quality of sleep. There were significantly positive correlations between quality of sleep and residual renal function(r=.368, p<.001), age(r=.184, p=.039), level of education(r=.188, p=.036) and hemoglobin(r=.396, p<.001). There were significantly negative correlations between quality of sleep and CRP(r=-.331, p<.001) and uremic symptoms(r=-.427, p<.001). Age(p=.001), level of education(p=.047), GFRs(p=.016), hemoglobin(p=.012), CRP(p=.006) and uremic symptoms(p=.014) predicted value accounted for 59.4% of the variance on quality of sleep(F=10.84, p<.001). Hence, health care providers should be concerned about helping to slow the progression of renal failure and considered related variables when planning an approach towards managing the sleep disorder in predialysis patients with CKD.

Keywords: *quality of sleep, chronic kidney disease, glomerular filtration rates*

1. Introduction

Sleep symptoms are common in patients with chronic kidney disease (CKD), and common symptoms include delayed sleep onset, frequent awakening, restless, and daytime sleepiness [1]. Numerous physiological processes are disrupted in patients with CKD, causing significant symptoms and, for all of us caring for these patients, representing important targets for intervention [2]. No consistent relationship has been detected between subjective sleep complaints of poor sleep and Blood Urea Nitrogen (BUN), creatinine [3]. Anemia has been associated with complaints of poor sleep with improvement after treatment with recombinant erythropoietin [4]. Sleep disorders affect the quality of life and may also increase cardiovascular morbidity and mortality [5]. Several epidemiological studies found that increased inflammatory biomarkers, especially C-reactive protein, are important risk factors for sleep disorder in patients with normal renal function [6]. Furthermore, chronic inflammation has been identified

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as a non-classic risk factor for cardiovascular complications of end stage renal disease (ESRD) patients [7]. It is possible that systemic inflammation is the link between sleep disturbance and reduced survival in ESRD [8]. Some researches showed ESRD patients with poorer sleep quality or insomnia had significantly higher CRP level [9]. However, these studies did not consider predialysis patients with CKD. The objectives of this study were to measure the prevalence of sleep disturbance in a prevalent population of CKD patients and to examine the association between quality of sleep and the other variables in this population.

2. Methods

2.1. Subjects and Data Collection

The subjects of the study were 126 patients who visited the nephrology outpatient department of a tertiary hospital in Seoul between December 12th and December 23th, 2012 and consented to participate in the study. Those who agreeded to answer the questionnaire were given it. Data were collected using face to face interview with a structured questionnaire. It took 5-10 minutes to complete the questionnaire. Regarding Glomerular Filtration Rates, hemoglobin and C-reactive protein (CRP) Electronic Medical Record (EMR) were referred.

2.2. Instruments

2.2.1. Quality of Sleep

Verran and Snyder-Halpern Sleep Scale (VSH): The scale was developed in order to assess the subjective sleep quality of hospitalized individuals – those without preexisting sleep difficulties. The VSH evaluates two domains of sleep experience: disturbance (including sleep latency, mid-sleep awakenings, soundness of sleep, and movement during sleep) and effectiveness (items relating to rest upon awakening, subjective quality of sleep, and total sleep period). Though the VSH was initially an eight-item scale, six additional items were added following psychometric evaluation in order to improve the range of difficulties queried by the scale. Responses are recorded along a 100 mm line, with 0 indicating that the sleep behavior or quality is not present, and 100 indicating that it is consistently experienced. The locations of the respondent's choices are measured in millimeters, and a global score is obtained by summing theses each item score. Higher scores indicate better quality of sleep [10].

2.2.2. Renal Function

The measurements of renal function was the estimated glomerular filtration rates (GFRs). For categorical analysis the subjects were separated, based on GFRs into five groups corresponding to the five stages of the K-DOQI classification of CKD.

2.2.3. Other Variables

Gender, age, occupation, educational level, uremic symptoms, hemoglobin and CRP were determined from interview and EMR review.

2.3. Data Analysis

Collected data were statistically analyzed with the SPSS WIN (ver. 12.0) program. Analysis included percentage, average, standard deviation, Pearson's correlation coefficient, *t*-test, ANOVA and multiple regression.

2.4. Ethical Consideration

Standard ethical and legal points were followed regarding the use of reporting subjects in research; salient, relative points were explained to all subjects. These guidelines included: participants right to withdraw from the project, anonymity, limitations on the use of resulting data, use for research and or academic purposes only, and the possible destruction of sensitive materials.

3. Results

3.1. General Characteristics of the Patients

The general characteristics of the patients are shown in Table 1. Participants included 58.7% male and averaged 66.0 years of age. Unemployed was identified in 58.7%, above college graduate in 34.9% of the participants. The mean level of hemoglobin and CRP were 11.2, 0.7 and respectively. The mean number of having uremic symptoms was 3.7.

Table 1. General Characteristics of Patients

N=126

Variable		N(%) or Mean±SD
Gender	Male	74(58.7)
	Female	52(41.3)
Age		66.0±10.4
	≤64	54(42.9)
	≥65	72(57.1)
Occupation	Yes	52(41.3)
	No	74(58.7)
Educational level	≤Middle school	42(33.4)
	High school	40(31.7)
	≥College	44(34.9)
Hemoglobin(g/dl)		11.2±1.9
Uremic symptoms (number)		3.7±2.6
C-reactive protein (mg/dl)		0.7±1.5

3.2. Quality of Sleep of the Patients

Sleep disorder was identified in 42.9% of the participants<Table 2>. Quality of sleep level showed a maximum score of 80 with a mean score of 48.6.

Table 2. Quality of Sleep of the Patients

N=126

Variable		N(%) or Mean±SD
Sleep disorder	Yes	54(42.9)
	No	72(57.1)
Quality of sleep	Mid-sleep awakening	5.6±2.7
	Movement during sleep	5.4±2.9
	Total sleep period	6.9±1.9
	Sleep latency	5.6±2.6
	Soundness of sleep	6.1±2.7
	Rest upon awakenings	6.0±2.6
	Method of awakening	7.6±2.3
	Subjective quality of sleep	5.5±2.4
	Total sleep score	48.6±15.0

3.3. Correlation between Quality of Sleep and Residual Renal Function

There were significantly positive correlations between quality of sleep and residual renal function(r=.368, p<.001) Table 3. There were significantly positive correlations between GFRs and mid-sleep awakening, movement during sleep, sleep latency, soundness of sleep, rest upon awakenings, method of awakening and subjective quality of sleep.

Table 3. Correlation Between Quality of Sleep and Residual Renal Function

	Glomerular Filtration rates	p
Mid-sleep awakening	.352	<.001*
Movement during sleep	.309	<.001*
Total sleep period	.002	.985
Sleep latency	.348	<.001*
Soundness of sleep	.265	.003*
Rest upon awakenings	.276	.002*
Method of awakening	.251	.005*
Subjective quality of sleep	.332	<.001*
Total sleep score	.368	<.001*

*p<.05

3.4. Characteristics of 'Sleep Disorder Patients' Compared with 'Non-sleep Disorder Patients' among the Patients

The Characteristics of 'sleep disorder patients' compared with 'non-sleep disorder patients' are shown in Table 4. Compared with 'sleep disorder patients', 'non-sleep

disorder patients' had a greater proportion of residual renal function subjects. The mean GFRs was lower in 'sleep disorder patients' compared with 'non-sleep disorder patients'.

Table 4. Characteristics of 'Sleep Disorder Patients' Compared with 'Non-Sleep Disorder Patients' among the Patients

Variable	Sleep disorder patients (N=54)	Non-sleep disorder patients (N=72)	*p*
Age (years)	67.2	64.5	.160
male (n)	29	45	.120
Employed (n)	24	28	.067
≤Middle school	24	18	.036
Glomerular filtration rates (mL/min/1.73m²)	16.8±9.8	29.1±18.1	<.001*
Hemoglobin(g/dl)	10.5±1.5	11.8±2.0	.041*
Uremic symptoms (number)	5.4±2.6	2.4±1.7	<.001*
C-reactive protein (mg/dl)	0.9±1.9	0.4±1.0	.001*

*p<.05

3.5. Quality of Sleep of the Patients by Stages

There was a significant difference in the quality of sleep of the subjects at each stage(F=10.94, p=<.001)<Table 5>. The Scheffe post hoc test confirmed that patients at higher stages had lower levels of quality of sleep. The results showed that patients at higher stages had higher sleep disorder.

Table 5. Quality of Sleep of the Patients by Stages

Variable		Stage 3 (N=32) N(%) or M±SD	Stage 4 (N=48) N(%) or M±SD	Stage 5 (N=46) N(%) or M±SD	F(*p*)
Sleep disorder	Yes	6(18.8)	18(37.5)	30(65.2)	
	No	26(81.2)	30(62.5)	16(34.8)	
Quality of sleep	Mid-sleep awakening	6.8±2.9	5.8±2.5	5.6±2.7	9.31(<.001*)
	Movement during sleep	6.4±2.7	6.0±2.3	4.4±2.3	8.77(<.001*)
	Total sleep period	6.8±1.7	6.7±1.9	7.0±2.2	0.26(.772)
	Sleep latency	6.3±2.3	6.5±2.3	4.1±2.5	13.7(<.001*)
	Soundness of sleep	7.0±2.7	6.5±2.2	4.1±3.1	5.89(.004*)
	Rest upon awakenings	6.4±2.4	6.5±2.1	5.0±2.4	6.18(.003*)

Method of awakening	8.4±1.8	7.7±1.9	6.9±2.8	4.00(.021*)
Subjective quality of sleep	6.3±2.4	6.0±1.9	4.4±2.3	7.97(.001*)
Total sleep score	54.6±15.2[c]	51.9±12.1[b]	41.1±14.9[a]	10.94(<.001*)

*p<.05
Post-hoc comparison=Scheffe, a<b<c

3.6. Correlation between Quality of Sleep and other Variables

There were significantly positive correlations between quality of sleep and age(r=.184, p=.039), level of education(r=.188, p=.036) and hemoglobin(r=.396, p<.001)<Table 6>. There were significantly negative correlations between quality of sleep and CRP(r=-.331, p<.001) and uremic symptoms(r=-.427, p<.001).

Table 6. Correlation between Quality of Sleep and other Variables

	Quality of sleep	p
Gender	.104	.244
Age	.184	.039*
Level of Education	.188	.036*
Occupation	.133	.139
Hemoglobin	.396	<.001*
C-reactive protein	-.331	<.001*
Uremic symptoms	-.427	<.001*

*p<.05

3.7. Factors of Affecting the Quality of Sleep in Predialysis Patients

Age(p=.001), level of education(p=.047), GFRs(p=.016), hemoglobin(p=.012), CRP(p=.006) and uremic symptoms(p=.014) predicted value accounted for 59.4% of the variance on quality of sleep(F=10.84, p<.001) Table 7.

Table 7. Factors of Affecting the Quality of Sleep in Patients

N=126

Factor variables	Standardized Beta	t	p	Adj R^2
Constant				.594
Age	.257	3.28	.001*	
Level of education	.165	2.01	.047*	
GFRs[†]	.132	2.41	.016*	

Hemoglobin	.146	2.56	.012*
C-reactive protein	-.219	-2.77	.006*
Uremic symptoms	-.225	-2.49	.014*

†, Glomerular Filtration Rates
*p<.05

4. Discussion

This study was to measure the prevalence of sleep disorder in a prevalent population of CKD patients and to examine the association between quality of sleep and the other variables in this population. The prevalence of sleep disorder in the present study was 42.9%. This is lower than 53% in a study on CKD patients [11]. This can result from the differences of study subjects. Average age of study subjects was 66.0, which is lower than 68.1 of Eduard et al's study [11]. This is a coincident result of the study that advanced age seem to be independent risk factor for sleep disorders [12, 13]. In the present study, we found significant relation between sleep disorders and CRP as inflammatory biomarkers. The incidence of patients were significantly higher than other patients. Previous studies confirm our results of insomnia and poor sleep [14]. As systemic inflammatory biomarkers, especially CRP, is elevated in most of CKD patients, it gives the impressions that inflammation leads in sleep disorders. So, investigations on prevention and treatment of inflammation are essential to prevent morbidity and mortality due to sleep disorders [14]. Regarding study results, there was significant correlation between the quality of sleep and GFRs as residual renal function's biomarkers. It may have been due to the fact that these patients' GFRs decreases as the uremic symptom increases such as itching sense, shortness of breath, restless legs, muscle spasm and muscle stiffness and pain in bones. This is accompanied by brief awakenings this disrupt sleep. Study results show that these patients had lowest movement during sleep in quality of sleep. It may have been due to the fact that related to RLS. Result of Kim and Choi' study support this assertion as the predialysis patients had restless legs and muscle spasm in having their uremic symptoms respectively [15]. Restless legs syndrome (RLS) is a sensorymotor disorder that is often associated with a sleep complaint. RLS is a common neurological condition characterized by 'an urge to move the legs, uncomfortable sensations in the legs and worsening of these symptoms during rest and in the evening with at least temporary relief brought on by activity' [16]. Patients with RLS usually report dysesthetic sensations when they are at rest. These sensations are generally relieved by agitated motor activity. Symptoms are worse later in the day or at night. Periodic limb movement disorder is the involuntary and periodic twitching or movement of a person's legs or arms every 20 to 30 seconds at least 5 times an hour during the night in periods of non-REM sleep. This is accompanied by brief awakenings this disrupt sleep [12]. Regarding study results, we found significant relation between sleep disorders and hemoglobin. There is a serious impact of hemoglobin levels on the quality of seep in ESRD patients. The SLEEPO study concluded that full correction of anemia with erythropoiesis-stimulating agents improves sleep in dialysis patients. It reduced arousals from sleep and sleep fragmentation, allowed for more restorative sleep, and improved daytime alertness [17]. Also, low hemoglobin is independently related to the presence of RLS in ESRD patients. RLS pathophysiology possibly involves the metabolism of iron, particularly in the brain. Iron deficiency disrupts the brain's dopaminergic system, because iron participates as a cofactor in the production of dopamine. Decline in brain iron may occur because of problems with the iron regulatory proteins [12]. Regarding study results, there was a

significant difference in the quality of sleep of the subjects at each stage. The patients at higher stages had lower levels of quality of sleep. As patients have different levels of quality of sleep on their stages, it is important to develop and use a systematic education program that reflects the levels of patients at each stage in order to help predialysis patients with CKD and improve their quality of life. As a conclusion of these findings, health care providers should be concerned about helping to slow the progression of renal failure and considered related variables when planning an approach towards managing the sleep disorder in predialysis patients with CKD.

References

[1] B. Barmar, Q. Dang, D. Isquith, D. Buysse and M. Unruh, "Am. J. Kidney Dis.", vol. 53, no. 665, **(2009)**.
[2] A. Salama and D. Nephrol, "Times", vol. 3, no. 14, **(2010)**.
[3] S. Walker, A. Fine and M. H. Kryger, "Am. J. Kidney Dis.", vol. 26, no. 751, **(1995)**.
[4] H. H. J ung, H. Han and J. H. Lee, "Am. J. Kidney Dis.", vol. 45, no. 875, **(2005)**.
[5] M. L.Okun, M. C. Read and M. H all, "Brain Behav. Immun.", vol. 3, no. 351, **(2009)**.
[6] M. J. Sarnak and A. S. Levey, "Am. J. Kidney Dis.", vol. 4, no. 117, **(2000)**.
[7] K. P. Parker, "Sleep Med. Rev.", vol. 7, no. 131, **(2003)**.
[8] H. Y.Chen, Y. L. Chiu and S. P. Hsu, "Q.J.M.", vol. 11, no. 837, **(2010)**.
[9] R. S. Halpern and J. A. V erran, "Research in Nursing and Health", vol. 10, no. 155, **(1987)**.
[10] A. Eduard, K. E. Iliescu, Y. Holland and D. C. Holland, "Nephrol. Dial. Transplant", vol. 19, no. 95, **(2004)**.
[11] G. C. Kosmadakis and J. F. Medcalf, "Int. J. Artificial organs", vol. 11, no. 919, **(2008)**.
[12] S. J. Han and H. W. Kim, "Healthcare and Nursing", Proceedings of the 16th International Congress of Advanced Science and Technology Letters, **(2014)**; Jeju island, Korea.
[13] E. Razeghi, M. A. Sahraian, R. Heidari and M. Bagherzadeh, "Acta. Neurol. Belg.", vol. 112, no. 45, **(2012)**.
[14] H. W. Kim and S. Choi, "J. Korean Biol. Nurs. Sci.", vol. 2, no. 82, **(2013)**.
[15] M. Z.Molnar, M. Novak and I. Mucsi, "Drugs", vol. 66, no. 607, **(2006)**.
[16] R. L. Benz, M. R. Pressman, E.T. Hovick and D.D. Peterson, "Am. J. Kidney Dis.", vol. 34, no. 1089, **(1999)**.

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