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Prevalence of sleep disorders in children aged 4-18 years with chronic kidney disease and comparing it with healthy population

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ABSTRACT

Introduction: Children with chronic kidney disease undergoing hemodialysis are facing many problems, one of the most important problems of these patients is sleep disorders, which affects the morbidity and mortality of these people. Therefore, this study was conducted with the aim of comparing the amount of sleep disorder in children with chronic kidney disease and healthy children of the same ages.

Materials and methods: This study is a case-control type. Children with chronic kidney disease and healthy children referred to the General Clinic of Hazrat Ali Asghar Hospital in year 2022 were included in the study. Sampling was done by easily available methods. 50 children in the case group and 50 children in the control group were examined. Children's sleep habits questionnaire was used to determine sleep disorders. Also, the demographic and clinical characteristics of the patient, including age, sex, BMI, and the researcher's checklist were recorded. Then the data of two groups were recorded and analyzed using SPSS software version 22. The p value in this study was considered less than 0.05.

Results: In this study, 60 cases of the all samples (60%) were girls (30 in the case group and 30 in the control group) and the average age in both groups was 8.79±3.68. The two groups were not significantly different in terms of age, gender and number of years of education. The number of family members in the samples was between 3-9. The severity of chronic renal failure in the group of patients was between 3-5 with an average of 4.32 ± 0.87. 48 cases (96%) of children with CKD had sleep disorder, which number was equal to 32 cases (64%) in the control group. Comparison of subgroup scores in the sleep disorder questionnaire, including sleep time, sleep behavior, night waking, waking up, daytime sleepiness, and other cases, all showed that the scores of subgroups were higher in patients with CKD. Also, in this study, parents of chronic kidney disease patients considered sleep disorder in their children to be less of a problem than parents of healthy children, and this was the case in all subgroups and the total score.

Conclusion: The results of this study showed that the prevalence of sleep disorders in children with chronic kidney disease is higher than in healthy children.

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1.INTRODUCTION

Chronic kidney disease is considered one of the most important health issues in the world in such a way that in terms of economic, social and psychological burden, it takes a large amount of government budgets; This disorder has been increasing in recent decades due to the growth of incidence and prevalence of diabetes, high blood pressure and obesity diseases (1). Despite the higher prevalence of chronic kidney disease (CKD) among adults, children have not been spared from this disease, and the prevalence of this disease among younger people is considered one of the problems facing mankind. Children affected by this disease are facing many problems in the future, among which we can mention cardiac, nutritional, metabolic and psychological problems (2). Among children between the ages of 28 days and 19 years old, who are hospitalized in the United States, CKD patients account for 3.8%. The most common cause of CKD in children is congenital anomalies in the kidney and urinary tract. Compared to other causes of hospitalization, these patients have a longer length of hospitalization, higher costs, and higher morbidity and mortality.

Therefore, investigating the problems and disorders associated with these patients, in addition to helping to improve their quality, is a great help to the amount of government expenses in the field of health (3,4). Chronic Kidney Disease (CKD) refers to a state of kidney damage that lasts more than 3 months and with at least one of the following: abnormal composition in blood or urine, abnormal kidney biopsy and abnormal images in investigations. Patients with chronic kidney disease undergoing hemodialysis struggle with many problems; The most common complication that affects these patients is high blood pressure and anemia. Another problem of these patients are sleep disorders, which affects the morbidity and mortality of these people (5-7). Sleep disorders include: snoring, insomnia, hypersomnia, sleepwalking, sleep paralysis, nightmares, night terrors, teeth grinding, nocturnal enuresis, restless leg syndrome, and sleep apnea. In addition, sleep can be accompanied by perceptual disturbances when falling asleep and waking up. Insomnia can also be the result of mental problems such as depression, anxiety and schizophrenia. Heart diseases, Alzheimer's and hormonal disorders are also other factors that can disrupt normal sleep (8, 9). Based on the studies conducted, people with CKD treated with hemodialysis, in addition to the above disorders, also have poor sleep quality, which is a consequence of various factors such as; Inflammatory factors, biochemical variables and low level of albumin (9). It is very difficult to measure the prevalence of sleep disorders in children due to cultural and moral differences, as well as the lack of a proper definition of healthy sleep among parents. So that in the first years of life, especially the first two years, it is very difficult and impossible to report how children sleep; Therefore, it is expected that the prevalence of sleep disorders among children is reported to be lower than the actual rate (10).

Considering the significant impact that sleep disorders have on the life process of people with CKD, as well as the high prevalence of chronic kidney disease and sleep disorders, the need to investigate and study in this field is vital; Therefore, the purpose of this study is to investigate the prevalence and types of sleep disorders in children and adolescents with stages 3 to 5 of chronic kidney disease, in order to accelerate to identify these disorders and take the necessary measures, to prevent their complications and to improve the quality of life and daily activities.

MATERIALS AND METHODS

The present study is a case-control study. The target population is all children with CKD and healthy children who refer to Ali Asghar Hospital clinic.

Sample size

In this study, sampling was done using an easily available method, and 100 healthy children with CKD were included in the study in year 2022.

Procedure

In this study, the Children Sleep Habit Questionnaire (CSHQ) was used to determine sleep disorders. The CSHQ questionnaire was first invented in America by Owens to collect the sleep habits of American children based on parents' answers about the sleep quality of school children. The main branches examined in this questionnaire are: child's sleep time, child's sleep behavior, waking up during the night, waking up in the morning, daytime sleepiness. The validity of this 33-item questionnaire for screening school-age children for sleep disorders has been previously confirmed, and overall internal reliability of 0.68 and a range of 0.36 to 0.7 in subgroups have been obtained. Comparing the results on samples available in the community and clinic has shown that the total score of 41 is the cut-off point for identifying children with the possibility of sleep disorders (11). The validity and homogeneity of the questionnaire has been confirmed by Wang et al.'s research with Cronbach's alpha = 0.80. The validity and reliability of the Persian version of this questionnaire was evaluated in the study of Fallahzadeh and his colleagues, and the Cronbach's alpha coefficient for the entire questionnaire was 0.80. There was a positive correlation between CSHQ and Bear's results. The range of convergent validity was obtained between 0.4 and 0.86, and in general, the validity and reliability of this questionnaire has been reported as acceptable in Iranian society (12). After the researcher's initial interview with the parents and obtaining informed consent to participate in the study, The CSHQ children's sleep habits questionnaire was completed by the researcher and through an interview with the parents. At the end, the collected data was analyzed. After analysis, the patients who had sleep disorders were followed up and referred to related medical centers.

Statistical analysis

First, the data were reported descriptively. The background variables were compared between the two groups and the sleep disorder score was also compared between them to obtain possible confounding variables. Finally, using linear regression, the difference between the raw scores between the two groups was adjusted based on the confounding variables. In describing the data, mean and standard deviation, median and interquartile range were used for quantitative variables, and number and percentage were used for categorical variables. The comparison between two groups was done in parametric quantitative variables using independent t-test and in non-parametric data, Mann-Whitney test was used. Chi-square test was used for categorical variables. All data analysis was done using SPSS version 24 software. The p-value in the study was considered to be 0.05.

Ethical considerations

In this study was conducted after the approval of the ethics committee of Iran University of Medical Sciences with the ethics code IR.IUMS.FMD.REC.1400.160. Before starting the study, the research objectives and how to do it were explained to the parents by the researcher, and after obtaining written consent from the parents, the questionnaire was provided to them. Parents are also assured that their documents will remain confidential.

RESULTS

In this study, 50 children with kidney failure disorder and 50 children without this disorder were included in the study as control group. The age of the children was between 4 and 17 years, and the average age of the children was 8.79 ± 3.68 years

and its standard deviation was equal. 60 cases of the samples (60%) were girls. Body mass index was between 11.52-27.64 with an average of 17.09±3.35. 32 children were under the age of entering school and the number of years of education of the rest of the children was on average 17.09 ± 3.35 years. The number of family members in the samples was between 9-3 and on average 4.1±3.35. The severity of chronic renal disease in the group of patients was between 3-5 with an average of 4.32 ± 0.87. The amount of creatinine in the group of patients was between 1 and 8.5 and the average was 3.5±1.86. The amount of GFR in the group of patients was between 4.03 and 55.9 and the average was 19.33±12.69. Age comparison between the two groups of patients and control shows that the two groups do not differ significantly in terms of age, gender and number of years of education. BMI was significantly lower in the patient group with an average of 15.69 ± 3.35 and significantly lower than the control group with an average of 18.48 ± 3.03 (P < 0.001). Also, the number of family members in the patient group with an average of 4.34 ± 1.32 was significantly higher than the control group with an average of 3.86 ± 0.84, and this difference was also close to significance (Table 1).

Table 1: Comparison of demographic and clinical characteristics in CKD and control groups

	group	**Mean**	**median**	**SD**	**Min**	**Max**	IQR	P-value
Age	Total	8.79	8.00	3.68	4.00	17.00	5.375	
	Kidney failure	8.97	8.00	3.86	4.00	17.00	5.50	0.729
	Control	8.61	8.00	3.52	4.00	16.00	5.25	
BMI	Total	17.09	16.47	3.35	11.52	27.64	4.75	
	Kidney failure	15.69	14.55	3.08	11.52	24.91	4.01	<0.001
	Control	18.48	18.69	3.03	13.61	27.64	4.06	
Number of years of education	Total	3.97	3.00	2.83	0.00	10.00	4	
	Kidney failure	3.69	3.00	2.90	0.00	10.00	3.50	0.381
	Control	4.22	4.00	2.79	1.00	10.00	4.00	
Number of family members	Total	4.10	4.00	1.13	3.00	9.00	2	
	Kidney failure	4.34	4.00	1.32	3.00	9.00	2.00	0.071
	Control	3.86	4.00	0.84	3.00	6.00	1.00	
Creatinine	Kidney failure	3.50	3.90	1.86	1.00	8.50	3.25	
GFR	Kidney failure	19.33	13.25	12.69	4.03	55.90	17	-
Disease stage	Kidney failure	4.32	5.00	0.87	3.00	5.00	2	-

Comparing the total scores of the two case and control groups in the study showed that the sleep disorder score in the patient group with a median and interquartile range of 64 and 13.25 compared to the control group with a median and interquartile range of 44.5 and 18.75 has a significant difference (P < 0.001). Considering the score of 41 as the cut-off point of the sleep disorder questionnaire, 48 people (96%) of the patients had sleep disorder and this number was 32 (64%) in the control group. This difference was statistically significant with P-value<0.001 and odds ratio of 13.5 (Table 2).

Table 2: Comparison of sleep disorder questionnaire score in case and control groups

Total score in sleep disorder questionnaire							
Group	Mean	Median	SD	Min	Max	IQR	P-value
CKD	62.34	64.00	12.21510	18.00	97.00	13.25	<0.001
Control	48.30	44.50	10.70428	37.00	70.00	18.75	

Examining the correlation coefficients showed that except for gender, other variables have an inverse correlation with the total score of the sleep disorder questionnaire. The linear regression equation shows a significant difference between the two study groups after adjusting for other possible confounding variables. In this equation, regression coefficients of 0.378, 0.543, -0.125 and -0.738 are significant for the group of patients, age, body mass index and years of education. The regression coefficients show that the sleep disorder score in the patient group is 0.328 higher than the control group if other variables remain constant. It also shows that gender and the number of family members do not have an effect on the sleep disorder score if the variables are matched (Table 3).

Table 3: Correlation coefficients between sleep disorder questionnaire scores and possible confounding variables

Variable	The correlation coefficient	P-value
Age	-0.394	<0.001
BMI	-0.576	<0.001
gender	0.088-	0.289*
Years of education	0.348-	0.006
the number of family members	0.203-	0.044
GFR	0.039	0.694
Creatinine	0.127-	0.202
Illness severity	0.026	0.82

* Pearson's correlation coefficient has been reported in all variables. Regarding gender, Kendall's correlation coefficient is reported.

Comparison of subgroup scores in the sleep disorder questionnaire, including sleep time, sleep behavior, night waking, waking up, sleepiness during the day, and other cases all indicated that the scores of subgroups were higher in patients with CKD (Table 4).

Table 4: Comparison of sleep disorder questionnaire score subgroups between two groups.

Variable	group	Mean	median	SD	Min	Max	Interquartile range	P-value t test
Bedtime	Patient	17.56	18.00	6.569	2	47	9.00	<0.001
	Control	12.78	10.00	5.024	8	23	10.25	
sleep behavior	Patient	25.14	26.00	4.417	6	30	4.00	<0.001
	Control	20.96	20.00	3.769	16	29	6.00	
Waking up at night	Patient	3.50	3.00	1.298	0	6	1.00	<0.001
	Control	2.54	2.00	0.706	2	5	1.00	
waking up	Patient	10.38	10.50	2.303	0	13	2.00	<0.001
	Control	8.30	8.00	1.555	6	13	3.00	
Drowsiness during the day	Patient	2.50	3.00	0.580	1	3	1.00	<0.001
	Control	1.32	1.00	0.471	1	2	1.00	
Other	Patient	3.26	3.00	1.121	2	6	2.00	<0.001
	Control	2.40	2.00	0.728	2	4	1.00	
Total	Patient	62.34	64.0000	12.21	18.00	97.00	13.25	<0.001
	Control	48.30	44.5000	10.	37.00	70.00	18.75	

Comparison of parents' opinions about children's sleep problems showed that parents of chronic kidney disease patients consider sleep disorders in their children to be less of a problem than parents of healthy children, and this is true in all subgroups and the total score (Table 5).

Table 5: Comparison of parents' opinions about children's sleep problems in both control and case groups.

Variable	group	Mean	median	SD	Min	Max	Interquartile range	P-value t test
Bedtime	Patient	2.6250	2.0000	2.63871	0.00	11.00	4.75	<0.001
	Control	5.8800	7.0000	4.52494	0.00	30.00	5.25	
sleep behavior	Patient	9.4468	10.0000	2.03030	6.00	15.00	3.00	<0.001
	Control	12.3750	13.0000	2.67872	6.00	15.00	3.75	
Waking up at night	Patient	1.2245	1.0000	0.79753	0.00	2.00	1.00	0.001
	Control	1.6800	2.0000	0.51270	0.00	2.00	1.00	
waking up	Patient	1.3265	1.0000	1.32897	0.00	5.00	2.00	<0.001

	Control	3.8200	5.0000	1.49407	0.00	5.00	3.00	
Total	Patient	15.8936	16	4.22844	10	30	5	<0.001
	Control	24.1667	27	7.37256	10	49	10.5	

The distribution of patients with CKD according to disease stage showed that 13 (26%) patients were in Stage 3, 8 (16%) patients were in Stage 4 and 29 (58%) patients were in Stage 5. Table 6 also shows that no There is no significant difference between stages of the disease with sleep time, sleep behavior and night waking. But this difference was significant in the sub-group of disturbance in awakening (P=0.005) (Table 6). Table 6: Comparison of sleep disorders in children with CKD by disease stage

DISCUSSION

Sleep is defined as the natural suspension of consciousness in terms of electrophysiology through specific brain wave criteria. More than 30% of every child's life is spent sleeping, and this state is vital for growth and development. For this reason, sleep pathology and the clinical consequences related to it are of special importance (13). Sleep disorder is one of the most common problems that children may face at different ages and it affects their quality of life. Children with CKD may experience physical and psychological problems, such as sleep disturbances. Sleep disturbance in children with CKD is associated with decreased quality of life. In this study, 50 children with CKD were included in the case group and 50 healthy children were included in the control group. 60 of the samples (60%) were girls and the age of the children was between 4 and 17 years. The two groups were not significantly different in terms of age, gender and number of years of education. The number of cases in the samples was between 3-9. In the patient group, the number of family members was significantly higher than in the control group. Although the number of family members, along with other factors such as the economic, social and cultural status of the family, can affect the occurrence of sleep disorders in children, but so far no study has evaluated its effect. 48 children (96%) with CKD had sleep disorder, which number was equal to 32 children (64%) in the control group. In Amira H. Darwish's study, sleep disorders were observed in 75.9% of children with CKD and in 19.5% of normal children in the control group (81.8% in dialysis patients and 71.8% in non-dialysis patients). Most of the children with CKD in the present study were between stage 3-5, while in Amira H. Darwish's study, most of the children with CKD were in stage 2. For this reason, the prevalence of sleep disorders in children in the case group in the present study is higher than in Darwish's study (14). In El-Baroudy's study, 40 children undergoing regular hemodialysis and 40 healthy children (6 to 15 years old) were examined in terms of sleep disorders and predictors of sleep efficiency. In this study, the Epworth Sleepiness Scale (ESS) was used to evaluate Excess Daytime Sleepiness (EDS). Also, the studied children were subjected to nocturnal polysonography to evaluate the total sleep time, the ratio of total sleep time (TST) to time in bed (TIB), sleep staging, apnea/hypopnea index and periodic organ movement index. The results of their study showed that in 20% of the cases, they had poor sleep efficiency, and in 45% of the samples, the periodic organ movement index was higher than 5, and in 40% of the cases, the apnea/hypopnea index was higher than 5. There was a negative and significant correlation between sleep efficiency and serum potassium, serum creatinine and sleep initiation. Multivariate linear regression analysis showed that serum creatinine is the only independent predictor of Sleep Efficiency (15).

The high prevalence of sleep disorder in the present study is in line with the results of many studies, especially in studies conducted on dialysis patients. Davis et al.'s study was one of the first to report sleep disorders in children and adolescents undergoing dialysis. They reported the prevalence of sleep disorders in a group of 21 children and adolescents under chronic dialysis equal to 86% (16). Also, in another study by Davis and his colleagues, the rate of sleep disorders in 159 school children with CKD was reported as 5.58 (17). According to the study of S Stabouli and his colleagues (a review of 12 articles), the prevalence of any sleep disorder ranged from 77 to 85% in dialysis patients, 32 to 50% in transplant patients, and 40-50% in non-dialysis patients. The most common disorder in this review was restless leg syndrome (prevalence 10-35%) (18). Dalimunthe and colleagues also evaluated sleep disturbances in 30 patients with mild to moderate CKD and 30 patients with severe CKD. 41 cases (68.3%) of them had sleep disorder, 29 cases (96.7%) were in the severe CKD group (19). In the Cláudia Gomes study, 8 children with automatic peritoneal dialysis with an average age of 10 years were studied. The average duration of dialysis was 8.4 months. Sleep disorder was observed in five patients (62.5%). The results of polysomnography decreased sleep efficiency (81.05 ± 0.09%) and latency (13.6 ± 11.6 minutes), increased wake time (23.08% of total sleep time), apnea/hypopnea index (8.1 ± 1.9). 1 per hour) and oxygen saturation index (4.5 ± 3.7). The average index of periodic leg movements was normal (0.78 ± 0.77 per hour) (20). Comparison of subgroup scores in the sleep disorder questionnaire, including sleep time, sleep behavior, night waking, waking up, sleepiness during the day and other cases all showed that the scores of subgroups were higher in patients with CKD Also, in this study, parents of patients with chronic kidney disease consider sleep disorder in their children to be a problem less than parents of healthy children, and this is true in all subgroups and the total score. In the study of Gomes and his colleagues, who used both the sleep disorder questionnaire and polysomnography, the data obtained from the questionnaire and polysomnography did not-matched with each other. They stated that the cause of this inconsistency was the low value of the presence of SD symptoms in the eyes of parents or children (20). Kun-Tai Kang studied the prevalence of sleep disorders in CKD children in a meta-analysis study. In this study, the prevalence of sleep breathing disorders (22%), obstructive sleep apnea (34%), excessive daytime sleepiness (27%) and insomnia/insufficient sleep was 14%. The prevalence of excessive daytime sleepiness in dialysis children was significantly higher than in non-dialysis children, and dialysis children also had a high prevalence of other sleep disorders. The risk of restless leg syndrome was 3.9 times and the risk of excessive daytime sleepiness was 9.6 times higher in children with CKD compared to the control group. In the current study, the sleep disorder in all subgroups (sleep time, sleep behavior, waking up, waking up, etc.) in the group of children with CKD was more than that of healthy children (21). In all studies that the amount of sleep disorders High prevalence of sleep disorder has been reported in children with CKD or undergoing dialysis. In the present study, due to the fact that most of the children were in stage 5 of the disease, the sleep disorder was very high.

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