

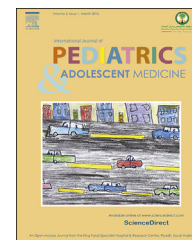
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ORIGINAL RESEARCH ARTICLE

Sleep disorders in children with chronic kidney disease

Q11 A.H. Darwish ^{a,*}, H.H. Abdel-Nabi ^b

^a Pediatric Department, Pediatric Neurology Unit, Tanta University Hospital, Faculty of Medicine, Tanta University, Egypt

^b Pediatric Department, Pediatric Nephrology Unit, Tanta University Hospital, Faculty of Medicine, Tanta University, Egypt

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KEYWORDS

CKD-not on dialysis;
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Abstract Objectives: This case-control study assessed the prevalence of sleep disorders among Egyptian children with chronic kidney disease (CKD), either maintained or not maintained on hemodialysis (HD), and compared them with healthy age and sex-matched children. **Patients and methods:** The total study population included 95 children, 54 of whom were CKD patients, 22 maintained on HD and 32 not maintained on HD; 41 healthy children of matched age and sex composed the control group.

Subjective impairment of sleep quality was assessed using the Arabic version of the Children's Sleep Habits Questionnaire (CSHQ). Daytime sleepiness and restless leg syndrome (RLS) were assessed using a pediatric modification of the Epworth sleepiness scale (ESS) and RLS Questionnaire, respectively.

Results: Sleep disturbances were detected in 75.9% of the studied children with CKD: 81.8% in children with CKD undergoing dialysis, and 71.8% in children with CKD not on dialysis. Excessive daytime sleepiness (EDS) and RLS symptoms were reported in 22% and 20.4% of the studied children with CKD, respectively.

Conclusions: Sleep disturbances are very common among children with CKD. Sleep disturbances in patients with CKD include restless legs syndrome (RLS), excessive daytime sleepiness (EDS), sleep-disordered breathing (SDB), behavioral insomnias and parasomnias.

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Abbreviations: CKD, chronic kidney disease; HD, Hemodialysis; eGFR, estimated glomerular filtration rate; CSHQ, Children's Sleep Habits Questionnaire; ESS, Epworth sleepiness scale; EDS, Excessive daytime sleepiness; RLS, restless leg syndrome; BMI, body mass index; ESRD, End stage renal disease; Hb, Hemoglobin; Ca, Total serum calcium; P, Serum phosphorus; SDB, sleep-disordered breathing.

* Corresponding author.

E-mail addresses: dradarwish2012@gmail.com (A.H. Darwish), hendabdelnabi@yahoo.com (H.H. Abdel-Nabi).

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1. Introduction

An adequate amount and quality of sleep are essential for normal growth, development and overall health of children. Disturbed sleep can adversely affect a child's daytime function, resulting in behavioral and emotional problems as well as decrements in daytime alertness and cognitive performance [1].

Sleep disorders are an important but often overlooked health problem in children with chronic kidney disease (CKD) [2]. To date, a small number of studies have focused on sleep disturbances in children with CKD. Additionally, the underlying mechanisms of sleep problems in CKD remain unclear. The aim of this study was to assess the prevalence and risk factors of sleep disorders among Egyptian children with chronic kidney disease (CKD), either maintained or not maintained on hemodialysis (HD), and to compare them with healthy children.

2. Patients and methods

The study was approved by the Institutional Review Board of Faculty of Medicine, Tanta University, and informed consent was obtained from all participants prior to inclusion.

The total study population included 95 patients, 54 of whom were CKD patients; 22 patients were maintained on HD, and 32 patients were not maintained on HD. Another 41 healthy children of matched age and sex served as the control group. Participants were recruited from the outpatient nephrology clinic and hemodialysis unit in the Department of Pediatrics, Faculty of Medicine, Tanta University Hospital, ALGharbia, Egypt from June 2014 to September 2015.

Children younger than 6 years of age were excluded, as they could not reliably comprehend the questionnaire about RLS. Children on sedative or hypnotic medications or suffering from any other chronic illness were also excluded.

The stages of CKD were determined based on the eGFR using the Schwartz formula [3].

National Kidney Foundation Disease Outcomes Quality Initiative (K/DOQI) CKD stages: [4]

1. Stage 1: eGFR \geq 90 mL/min/1.73 m²
2. Stage 2: eGFR = 60–89 mL/min/1.73 m²
3. Stage 3: eGFR = 30–59 mL/min/1.73 m²
4. Stage 4: eGFR = 15–29 mL/min/1.73 m²
5. Stage 5: eGFR < 15 mL/min/1.73 m², or receiving dialysis.

Subjective impairment of sleep quality was assessed using the Children's Sleep Habits Questionnaire (CSHQ) [5]. The children's mothers completed the Arabic version of the CSHQ [6]. The CSHQ was translated, modified and validated for this population and culture. It is a retrospective, 33-item parent questionnaire grouped into eight subscales reflecting the following sleep domains: bedtime resistance (5 items), sleep onset delay (1 item), sleep duration (3 items), sleep anxiety (3 items), night waking (3 items), parasomnias (7 items), sleep-disordered breathing (3 items), and daytime sleepiness (8 items) [7].

The Total Sleep Disturbance score included all of the items from the eight subscales; the parents were asked to recall sleep behaviors occurring over a "typical" recent week. Items were rated on a three-point scale: "usually" if the sleep behavior occurred 5–7 times/week, "sometimes" 2–4 times/week and "rarely" for zero to one time/week. Each question was scored from 1 to 3, (one being rarely, 2 being sometimes, and 3 being usually) and then summed to create a total sleep score (with the total ranging from 33 to 99). Some items were reversed to make a higher score indicative of more disturbed sleep. Higher scores indicated a poorer quality of sleep. A total sleep score of 41 on the CSHQ is reported as the clinical cutoff for the identification of probable sleep problems [5].

A pediatric modification of the Epworth sleepiness scale (ESS) was used to assess daytime sleepiness, in which subjects were asked to rate, on a scale of 0–3, how likely they would be to fall asleep in eight situations [8]. Excessive daytime sleepiness (EDS) was defined as an ESS score \geq 11.

The restless leg syndrome (RLS) Questionnaire, derived from the standard criteria for the diagnosis of RLS in children and adolescents [9], was administered to determine the prevalence of RLS. Patients were given a positive diagnosis of RLS if they had a positive response to four standard questions: (1) an urge to move due to uncomfortable sensations in the legs, (2) uncomfortable sensations that are relieved by movement, (3) symptoms worsen during rest or inactivity, and (4) symptoms worsen in the evening. The questionnaire was filled out by the parent in the presence of the child for children aged 6–12 years and independently by older children and adolescents.

2.1. Statistical analysis

Descriptive statistics were calculated as the mean \pm SD for continuous variables and as numbers and percentages for categorical variables using SPSS V.16. Group differences were tested using the chi-square test for categorical variables and one-way ANOVA for continuous variables. ANOVA was followed by a Tukey HSD (Honestly Significant Difference) post hoc test. Correlation coefficients and linear and logistic regression models were used to evaluate the association between sleep disturbance and variables such as age, BMI, and eGFR. All tests were two-sided, and differences were considered to be significant at $P < .05$.

3. Results

Studied groups' characteristics and demographic data are presented in Table 1. The total study population included 95 patients, with 54 CKD patients, 22 patients maintained on HD (n 22; M/F 12:10) and 32 CKD patients not maintained on HD (n 32; M/F 19:13); 41 healthy children of matched age and sex served as a control group (n 41; M/F 23:18). End stage renal disease (ESRD) patients were undergoing regular HD three times/week for 3–4 h using bicarbonate dialysis to maintain a minimum Kt/V index of 1.2 per session.

The studied groups' laboratory data are presented in Table 2. Serum creatinine, hemoglobin, calcium, and phosphorus were significantly higher in CKD children on hemodialysis compared to non-dialysis-dependent CKD

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