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Prevalence and Patterns of Sleep Disorders in Diabetic children referred to Endocrine Clinic of Ali Asghar Hospital

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Abstract

Background and Objective: Sleep is a transient altered level of consciousness, relative suspension of sensory perceptions and inactivation of voluntary muscles during rest. It has important role in quality of life. Some chronic diseases such as Diabetes mellitus type 1(T1D) are accompanied with sleep disturbances which may lead to poor glycemic control. Our study was conducted to investigate sleep disorders in children with type 1 diabetes.

Methods: This cross-sectional study was conducted on 104 children with T1D referred to endocrinology clinic from October 2018 to March 2019 in Ali Asghar Children Hospital. Patient's characteristics including age, sex, weight and height were recorded in the data collection form. For each patient, questionnaire was filled out by the researcher with Children Sleep Habit Questionnaire (CSHQ).The collected data were analyzed with SPSS.

Results: In this cross-sectional study, 104 diabetic patients aged 2-17 years were enrolled. Sleep disorders had high prevalence of 94 percent. There was significant relationship between age and sleep disturbances(p=0.003).Some common abnormal items included need to parents' attendance for sleep in 44 (42%), bad mood in the morning in 35 (33.5%), afraid of sleep in darkness in 29 (28%), afraid of sleep alone in 25 (24%), sleep in others' beds in 20 (19%), avoidance to go to bed in 16 (15.5%),try to not start sleep in 11 (10.5%) and awake with others' force in 10 (9.5%)cases was seen.

Conclusion: Prevalence of sleep disorders in T1D, irrespective to gender or BMI, is high. Preventing sleep disorders with an emphasis on screening for this problem in T1D patients and education for sleep hygiene is necessary.

Keywords: Children, Diabetes mellitus, Sleep disorders.

Introduction

Diabetes mellitus and its management in children are considered as important health challenges. This disease has different types and type 1 diabetes mellitus (T1D) is common form in childhood period. In one study, the prevalence of T1D in young people under age of 20 years was reported about 2 cases per 1,000 people. There are various risk factors such as age, sex, genetic, geographical region, and season for starting disease in children. T1D is an autoimmune diabetes mellitus with beta-cell destruction after an acute stress such as infection and lead to insulin decrement, and its clinical symptoms begin with polydypsia, polyuria, weight loss and rarely diabetic ketoacidosis. Insulin therapy, glycemic monitoring, measuring hemoglubin A1c and lifestyle modification including diet and exercise play important role in the care of diabetic patients (1, 2). Proper control of blood sugar in diabetic patients is related to sleep, which help to better care in these patients. Identifying sleep disorders in diabetic children is of particular importance because these disorders also cause weakness in cognitive, behavioural, attention, concentration and academic function and lead to decreased quality of life (3, 4).

Studies have shown that sleep in children and adults with diabetes has lower quality compared to healthy people (5, 6). Children and young adults with T1D spend more sleep time in light sleep i.e. stage 2 sleep than healthy people, and are less in deep sleep or stage 3 of sleep (7, 8).

Changes in neuroendocrine hormones such as growth hormone, epinephrine and ACTH during

the night in people with T1D are higher than normal levels (8). The effects of abnormal sleep on hemoglubin A1c levels and blood glucose control are also known, causing its level to be higher than normal subjects (9-11).

Also sleep duration is effective on control of blood sugar, and sleep with shorter durations, for example less than 5.6 hours, increases A1c hemoglubin levels (12). In addition, the less time it takes in deep sleep (sleep with slow waves), the higher level of hemoglubin A1c (13). On the other hand, reducing sleep time reduces insulin sensitivity. This finding shows that limiting sleep time, which is a very common habit among people, has a negative effect on glycemic control (14).

Respiratory disorders are the most common sleep disorders and in this group of diseases, obstructive sleep apnea is more common in people with T1D and type 2 diabetes mellitus and for investigating, apnea index (number of apnea per hour) is used. Studies have shown that apnea index is higher than normal in type 1 diabetic patients (15, 16). Obstructive apnea and severe daytime sleepiness in people with type 1 diabetes -with normal BMI -were also seen more and had a significant relationship with glycemic control (17).

There is no any report about difference between diabetic and healthy people in other sleep disorders such as restless leg syndrome, insomnia and narcolepsy (9). T1D can decrease counter regulatory hormone responses and lead to decreased response to wake-up following hypoglycemia (18). Furthermore, increasd blood sugar in T1D has a negative effect on melatonin levels and changes normal sleep cycle (19).

This study was conducted to investigate the prevalence and patterns of sleep disorders in children with T1D to identify these problems and help to solve it, to better control diabetes and also to better quality of life of these patients.

Methods

This cross-sectional study was conducted on 104 children with T1D who referred to endocrinology clinic from October 2018 to March 2019 in Ali Asghar Children Hospital.It was started after ethic committee permission (code: IR.IUMS.FMD.REC.1397.181). The patient's characteristics included age, sex, height and weight for measuring body mass index (BMI) was recorded. Child sleep habits questionnaire (CSHQ) was filled with parental help and by the researcher. Data were recorded in prepared checklists. Finally, the collected data were analyzed by SPSS 26 software.

The patients' weight were measured by the staff using digital scale in the endocrinology clinic without heavy clothing and shoes, based on kilograms and with the accuracy of 0.1 kilogram. Patients' height was measured by an intact meter. Body mass index (BMI) was calculated by its formula (kilogram/ square meter). According to World Health Organization tables, appropriate to age and sex, BMI for each patient was calculated. Percentiles less than 5 as underweight, 5-85 as normal weights, 85-95 as overweight and above 95 as obesity were considered.

CSHQ is a questionnaire with 45 items that is rated by parents about child sleep difficulties. According to Owen scoring, it decreased to 35 more important items (20). It included demographic characteristics of individuals and eight main items which were completed by questioning parents and their evaluation from children's sleep pattern during the past week. Parents had three options to choose for each of the questions: usually (5-7 nights per week), sometimes (2-4) nights per week and rarely (0-1 nights per week).Score up to 41 was considered as normal and more than 41 as sleep disorders.

The main items are including: 1.Resistance of sleep time, itself has 6 sub-branches such as going to bed at a specified and fixed time.2. Delayed sleep onset time including: starting sleep in less than 20 minutes. 3. The duration of the sleep that it has three sub-branches, such as very short sleep. 4. Sleep anxiety with 4 sub-branches such as asking the child for parental presence in the bedroom 5.Frequent night awakenings include 3 subcategory such as going to bed with other family members at night. 6. Parasomnia with 7 sub-branches such as nocturnal enuresis. 7. Respiratory diseases in sleep with 3 sub-branches such as snoring and puffiness.8.Daytime sleepiness with 8 sub-branches such as inability to wake up on their own. At the same time, the total score of sleep disorders can be obtained by this questionnaire, according to the main questionnaire designed by Owen et al (20). In this test, Cronbach's alfa was 0.78 in the sample of clinic. Higher scores indicated more sleep problem.

Results

In this cross-sectional study, 104 diabetic patients aged 2-17 years, with mean age 8.41±4.05 year old, were enrolled. Sixty (58%) patients were male and 44 (42%) of cases were female. Body mass indexes was calculated and included normal in 66 (63.5%), overweight in 27 (26%), obesity in7 (6.7%) and underweight in 4 (3.8%) cases. Sleep disorders were observed in 98 (94%) patients.

In bed resistance item with median of 9 ,61 cases had scores of 5-9 and 43 cases had scores of 10-14.About sleep duration including little time sleep ,with median of 5, 82 cases had lower scores (score= 2-5) and 22 cases had higher scores (score= 6-8). In sleep anxiety items with median of 5, there was minimum scores (score= 4, 5) in 52 cases and 12 cases had maximum scores(score= 6-10). About sleep onset, 82 cases didn't have problem in starting the sleep after twenty minutes and 22cases had disturbances. In sleep difficult breading items including snoring, gasping and apnea, with median of 3, minimum scores (score= 3) was seen in 95 cases and 9 cases had maximum scores (score= 9). In parasomnia items including bed wetting, nightmare and restless, with median of 8, lower scores (score= 7-10) was seen in 53 cases and 51 cases had higher scores (score= 11-13). In night walking items with median of 3, 64 cases had lower scores (score= 3) and 40cases had higher scores (score= 4-7).

About diurnal sleepiness including falling asleep during playing, with median of 13, 77 cases had lower scores (score= 2-13) and 22 cases had higher scores (score= 14-20). Some common items of sleep disorders in 104 diabetic patients are shown in Figure 1. There was a significant relationship between age and total score of CSHQ (p=0.003), with more problem in younger children. No relationship was seen with gender, BMI and sleep disorders (p=0.2 and 0.3).

Discussion

In this study, the prevalence and types of sleep disorders in T1D was assessed and it was detected that total score of sleep disorders was high. The higher level of disturbance was related to bedtime resistance with sub title of "needs parent in room to sleep" and there was no problem as scary dream.

Results of the study of Ozgoli et al. in 2016 in Iran showed that 25.6% of children had moderate to severe sleep disorders, 9.64% had disturbances in wakefulness in the morning and 9.28 had sleep behaviour disorders (20). In 2012, Khazaei et al. demonstrated that sleep behaviour disorders, particularly resistance to sleep (5.27%), was the most inappropriate sleep habits of children (21).

Some studies have attributed the relationship between sleep hours and blood glucose changes in diabetic patients to hormonal factors. Decreased sleep duration leads to a decrease in leptin (satiety factor) and an increase in ghrelin (appetite stimulant). Release of growth hormone and ghrelin by raising cortisol levels can link the relationship between hours of sleep and changes in blood sugar to hormonal factors (22).

In koren et al. study in 2011, decreased sleep duration was related to increased glycosylated hemoglubin levels in patients (23) Cappucci et al. in 2008 after analyzing 17 studies in this field, It was concluded that sleeping less than 5 hours for adults and sleeping less than 10 hours for children was associated with obesity (24) and also accord-

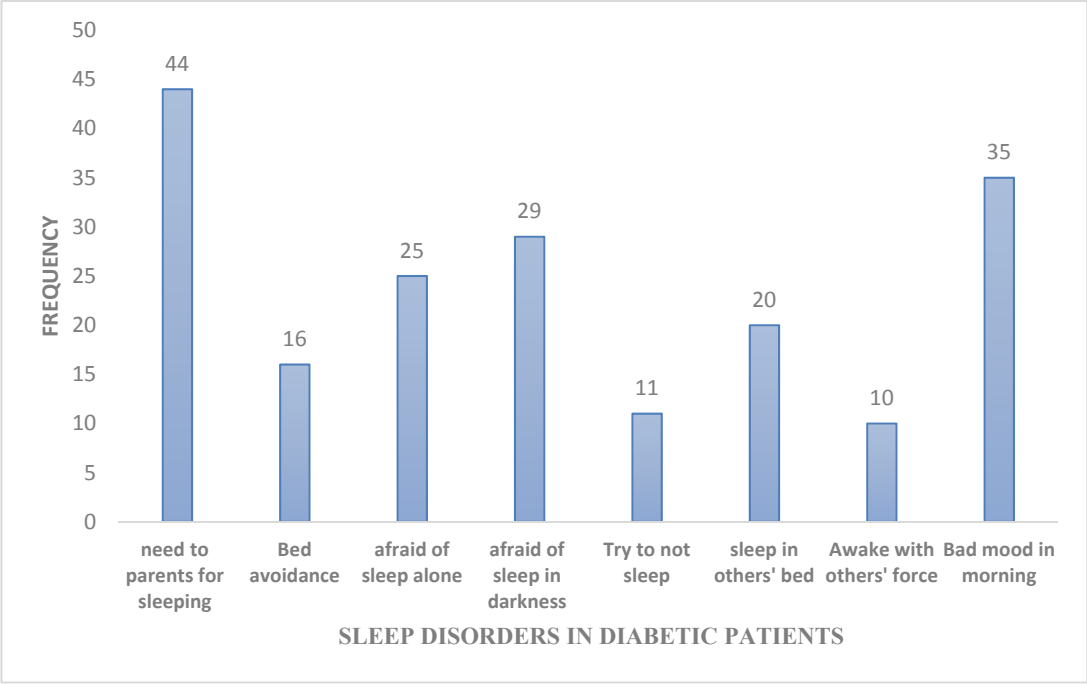

Fig 1. Common sleep disorders in Diabetic Patients

ing shigeta study ,obesity in people with sleep less than 6 hours was twice than other people (25) In the current study, BMI was not associated with any aspects of sleep disorder in patients with T1D. While in Rontoyanni study there was a relationship between the duration of night sleep and body mass index and there was an increase of 8.2% body fat when nighttime sleep duration decreased one hour (26).

In a study in Japan, BMI in men with sleep less than 6 hours and more than 9 hours at night was higher than men with normal sleep of 7 to 8 hours, while there was no relationship between night time sleep duration and women's weight (27). In our study, age was associated with sleep disorders in patients with T1D, lower ages was accompanied with more sleep problems. In a study in 2013 was conducted by Ghafoorifard, found no significant relationship between sleep disorders and age (28). It may be because of higher age and different type of disease (T2D) in their study. We didn't find study about age and sleep disorders in diabetic children.

In the present study, although sleep disorders was seen more in males, there was no significant relationship between gender and sleep disorders. The Study of Andrea Dzaja et al. was conducted in 2004 with the aim of investigating sleep disorders in female patients, showing that the prevalence of sleep disorders in women is higher than in men (29). But in the 2017 Shamsaee et al. study, as in our study, significant relationship between gender and sleep disorder was not found (30).

In our study, BMI was not associated with any aspects of sleep disorders in patients with T1D. A study by Iranian researcher in 2014 with the aim of investigating the relationship between sleep duration and blood sugar in patients with type 2 diabetes was performed. It was found that the mean BMI of subjects was 30 and there was no significant relationship between sleep disorders and BMI (22).

There was some limitations in our study .Sample size was small without multicenter assessment. We didn't have polysomnography for advanced assessment of sleep disorders and had to referred our patients to another centre that made follow up difficulties.

Conclusion

The present study, the overall score of sleep disorders in diabetic children was high. There was significant relationship between the prevalence of sleep disorders with age, but no about sex and BMI. However, the high score of sleep disorders in these patients indicates that it is necessary to prevent sleep disorders with an emphasis on screening and identifying these disorders as well as sleep hygiene with educational programs in diabetic patients.

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Conflicts of interest: None declared.

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