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Original Article

Subjective Sleep Quality in Type-2 Diabetics

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Abstract

Background: Poor sleep can challenge normal glucose homeostasis in type-2 diabetics and usually is under-diagnosed. The study aimed to assess subjective sleep quality and duration among diabetics.

Methods: A cross-sectional study was carried out in a tertiary care center in Visakhapatnam during the period from January 2018 to April 2018. A total of 444 type-2 diabetics, aged ≥18 years were recruited. Subjective sleep quality was assessed using Pittsburgh Sleep Quality Index (PSQI) with cut off value >5 indicating poor sleep quality. Participant's demographic features, co-morbid conditions, body mass index and glycemic profile were collected.

Results: Subjective sleep quality was poor in 54.95% of diabetic patients. The mean global PSQI score was 6.08±2.84. Pain was the highest reported sleep-related problem followed by nocturia. The Multivariate Logistic Regression analysis showed that females, physical inactivity, duration of DM >5 years, co-morbid conditions and poor glycemic control had significant association with subjective poor sleep quality in diabetics.

Conclusion: Nearly half of the diabetic patients reported poor subjective quality of sleep with poor glycemic control.

Introduction

Sleep hygiene forms the fourth pillar for Diabetes Mellitus (DM) management along with nutrition, physical activity and pharmacotherapy. Being closely related to endocrine-metabolic processes and sympathovagal modulation, the duration and quality of sleep are key determinants for insulin sensitivity (1). Sleep curtailment or disruption of normal sleep cycle can result in up-regulation of hypothalamic-pituitary-adrenal axis, high sympathetic output and immunoinflammatory activation (2) which may interfere with normal pancreatic beta-cell responsiveness,

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cellular insulin signaling and peripheral glucose uptake resulting in hyperglycemia and insulin resistance. Another potential pathway is sleep impairment inducing dysregulation of neuroendocrine control of appetite due to alteration in secretory profile of leptin and ghrelin leading to excessive food intake and decreased energy expenditure (2).

Also, diabetics may experience issues with their sleep owing to co-morbid pathologies. Thus, sleep disturbances may be the cause or consequence for development of insulin resistance and DM. Poor sleep often remains under-diagnosed by the treating physicians in diabetic care. So, the study aimed to investigate self-reported sleep behavior in diabetics.

Methods and Materials

This observational cross-sectional study was conducted in the outpatient department (OPD) of General Medicine, GVP IHC & MT, Vishakhapatnam from January 2018 to April 2018. The study protocol was approved by the Institutional Ethical Committee. After explaining the nature of the study to subjects, informed written consent was obtained. Participation was voluntary, assuring confidentiality.

Confirmation of diagnosis of DM in the subject was done as per American Diabetic Association Guidelines (3). Exclusion criteria included age <18 years, type-I DM, pregnancy or lactation, any psychiatric disorder or use of any psychotropic drugs, diagnosed case of sleep disorder, other endocrine disorders like thyroid disorders or on hormone therapy like glucocorticoids medications, severe cognitive impairment and refusal to participate.

Demographics features, characteristics of DM, co-morbid conditions, anthropometric measurements, Pittsburgh Sleep Quality Index (PSQI) were obtained by face-to face interview. The demographic information included age, gender, education, marital status, addiction, diet, physical activity. Based on history taking, physician's records and clinical examination, details of DM and co-morbidities were obtained. The glycemic control was assessed by HbA1c measurement. HbA1c > 6.5% indicated poor glycemic control (3).

Pittsburgh Sleep Quality Index[4]

It assessed subjective responses on sleep over past 4 weeks. It consisted of 19 items grouped into 7 sub-components: C1) Subjective Sleep Quality; C2) Sleep Latency; C3) Sleep Duration; C4) Habitual Sleep Efficiency; C5) Sleep Disturbances; C6) Use of Sleeping Medication; and C7) Daytime Dysfunction. Each subcomponent was scored on a 4-point Likert scale (0, 1, 2, and 3). The total of 7 scores yielded a global score in a range of '0'–'21' points. A higher global score was suggestive of worse sleep quality. Score >5 was considered as poor quality of sleep.

Score >5 has diagnostic sensitivity of 89.6% and specificity of 86.5% in differentiating poor sleepers from good sleepers. PSQI has high reliability and validity with good internal consistency (Cronbach's-α of 0.70-0.83).

The PSQI Global score was set as dependent variable. The independent variables constituted gender, age, Body Mass Index (BMI), physical inactivity, duration of DM, HbA1c and presence of co-morbid conditions. They were dichotomized as: gender (male vs. female); age ($\leq$50 years vs. >50 years); BMI (<23 kg/m^2 vs. $\geq$23 kg/m^2); duration of DM ($\leq$5 years vs. >5 years); HbA1c ($\leq$6.5% vs. >6.5%); physical inactivity and co-morbid conditions (present vs. absent)

The data was analyzed using Statistical Package for Social Sciences (SPSS) version-22. Quantitative variables were expressed as Mean and Standard Deviation (SD). Categorical variables were computed as frequency (n) and percentage (%) and were analyzed by Chi-square test. Multivariate Logistic Regression analysis was used to evaluate independent variables. Statistical significance was set at p-value <0.05.

Results

467 diagnosed type-2 DM patients were screened for the study. 23 were excluded as 14 had thyroid disorders and 9 were on psychotropic drugs. So, the analysis was restricted to remaining 444 subjects.

Females constituted 57.66% (n=256) of the total

study population. The mean (±SD) age of the subjects was 53.33±10.49 years. The mean BMI obtained was 23.05±3.76 kg/m^2. The mean duration of DM was 4.63±5.40 years. Co-existing hypertension was observed in 40.32% subjects.

The mean global PSQI score was 6.08±2.84 and 244(54.95%) had global score >5, indicating poor sleep. The average sleep duration was 6.37±1.03 hours per day and 242(54.50%) diabetics reported <7 hours of sleep. The average sleep latency was 39.08±27.44 mins. Pain and nocturia was reported by 201(45.27%) and 197(44.37%) diabetics respectively as leading sleep-related disturbances (Table I).

The Multivariate Logistic Regression analysis of independent variables showed that females [OR-2.23; 95%CI: 1.52–3.27, p = 0.00039], physical inactivity [OR-6.59; 95%CI: 4.02–10.79, p<0.00001], duration of DM more than 5 years [OR-1.93; 95%CI: 1.31–2.86, p = 0.0008], presence of co-morbid conditions [OR-1.87; 95%CI: 1.22–2.85, p = 0.0035] and poor glycemic control [OR-1.5; 95%CI: 1.03–2.2, p = 0.036] were independent risk factors for subjective poor sleep quality in diabetics (Table II).

TABLE I: Indicators of sleep quality in diabetic patients based on PSQI

Variable	*n(%)*
Sleep quality	
Good/very good	225 (50.78)
Bad/very bad	219 (49.22)
Sleep latency	
≤15 minutes	161 (36.26)
>15 minutes	283 (63.74)
Sleep duration	
≥7 hours	202 (45.50)
<7 hours	242 (54.50)
Habitual sleep efficiency	
≥85%	406 (91.44)
<85%	38 (8.56)
Use of sedatives	
Present	5 (1.12)
Absent	439 (98.88)
Daytime dysfunction	
Present	64 (14.41)
Absent	380 (85.59)
Sleep-related disturbance	
Snoring	122 (27.48)
Coughing	20 (4.50)
Pain	201 (45.27)
Nocturia	197 (44.37)
Global PSQI score	
≤5	200 (45.05)
>5	244 (54.95)

TABLE II: Multivariate Logistic Regression Analysis of variables related to Subjective Sleep Quality.

Variable		*PSQI score*			χ^2	*p-value*	*Odd's ratio*	*95% confidence interval*
		Total	*≤5 n=200*	*>5 n=244*				
Gender					16.93	0.00039*	2.23	1.52–3.27
	Males	188	106	82				
	Females	256	94	162				
Age					3.62	0.57	1.44	0.99–2.11
	≤50 years	189	95	94				
	>50 years	255	105	150				
BMI (kg/m^2)					0.048	0.825	0.96	0.66–1.39
	<23	229	102	127				
	≥23	215	98	117				
Physical inactivity					64.03	<0.00001*	6.59	4.02–10.79
	Absent	144	88	26				
	Present	330	112	218				
Duration of DM					11.23	0.008*	1.93	1.31–2.86
	≤5 years	207	92	115				
	>5 years	237	69	168				
HbA1c					4.37	0.036*	1.5	1.03–2.2
	≤6.5%	176	90	86				
	>6.5%	268	110	158				
Co-morbid conditions					8.50	0.0035*	1.87	1.22–2.85
	Absent	146	70	62				
	Present	298	101	167				

*- statistically significant (p<0.05)

Discussion

The present study revealed poor subjective quality of sleep (PSQI global score >5) in 54.95% of diabetic patients. Using PSQI, Kodakandla K *et al.* (5) and Cho E-H *et al.* (6) had observed poor sleep in 64% and 49% of type-2 diabetics respectively. Females were more vulnerable for poor sleep as compared to males similar to findings by Suarez *et al.* (7) who attributed mosaic of plasma biomarkers and psychosocial distress for poor sleep in females.

Duration of DM more than 5 years and existence of co-morbid conditions were significantly associated with poor sleep quality in the present study. Pain and nocturia were reported by 45.27% and 44.37% diabetics respectively for either delaying onset or interfering with maintenance of sleep. These symptoms are mainly attributed to diabetic neuropathy and hyperglycemia induced osmotic diuresis respectively (8). Other etiologies for pain could be peripheral vascular disease, osteoarthritis. Even metformin-induced vitamin-B_{12} deficiency is known to exacerbate peripheral neuropathy (9). Nocturia in diabetics could be due to other co-morbid conditions like uncontrolled hypertension, benign prostatic hypertrophy and urinary incontinence, diuretics use at bedtime, excessive water intake just before sleep. Control of troublesome triad of hyperglycemia, nocturia and neuropathic pain may benefit diabetics by reducing sleep disruption.

HbA1c was significantly higher and exhibited strong association with poor sleep quality among diabetics, comparable to observation by Kodakandla K et al (5). Spiegel K had similar findings in normal healthy sleep-deprived individuals (1). Sleep impairment effectuates changes in hormonal and biochemical profile resulting in inefficient insulin-mediated glucose utilization, thus inducing insulin resistance and hyperglycemia (1). Thus, adequate sleep with balanced architecture is required for normal glucose homeostasis. National Sleep Foundation recommends minimum 7 hours of sleep for young and older adults. 242 (54.50%) of diabetics reported <7 hours of sleep duration.

The present study revealed physical activity being more significantly prevalent amongst good than poor sleepers (44% vs. 10.66%). Absence of physical activity had significant association with poor quality of sleep. Sleep impairment causes reduced alertness, daytime hypersomnolence and impaired cognition. These may reflect as poor medication adherence and unhealthy lifestyles thus fuelling the endocrine-metabolic pathophysiological pathways for poor glycemic control. Exercise and sleep extension in home environment in sleep-deprived individuals have potential to improve insulin sensitivity and glycemic control.

In the present study, sleep quality was not influenced by advancement in age; similar to observation by Kodakandla K *et al.* (5). However, Madrid-Valero JJ *et al.* (10) had observed direct relationship between age and decline in sleep quality. Hence, aging can't be the sole determinant for deteriorating sleep quality in diabetics, thus emphasizing identification of other vulnerabilities.

Sleep disorders in diabetics, an under-rated challenge, requires a 'multidisciplinary' as well as 'individualized' approach. Promoting sleep hygiene, early recognition of sleep disturbances and its precipitants by clinicians and alignment of appropriate services can have positive clinical outcome and improve patient's well being and quality of life.

The study has few limitations. The sleep data was subjective, not supplemented by the objective measurements by polysomnography or actigraphy.

Conclusion

The present study exhibited higher prevalence of poor sleep quality in diabetics. Pain and nocturia were leading causes of sleep disturbances. Poor quality of sleep was significantly associated with females, physical inactivity, duration of DM >5 years, existing co-morbid conditions and poor glycemic control. Along with pharmacotherapy and lifestyle modifications, ameliorating sleep quality in affected individuals may be rewarding for achieving target glycemic control.

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