Duration and Quality of Sleep in the Severity of Type 2 Diabetes Mellitus in Rural India

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Abstract: Aim of the study was to enumerate the sleep duration and sleep quality in type 2 diabetes patients in rural INDIA. Material and methods: All the patients underwent an interview to record information on age sex and duration of diabetes. HbA1C, and mean blood glucose were done. At the end of the visit, each participant was asked to complete PSQI, a validated 19 questionnaire used to measure the quality and pattern of sleep in the past 1 month. It produces global quality score from 0 to 21, derived from seven components. The components include subjective sleep quality, sleep latency, sleep duration habitual sleep efficacy, sleep disturbances, use of sleep medication, and day time dysfunction. People with a global score equal or less than 5 are defined to have good sleep quality, while a global score more than 5 identifies those with poor sleep quality. This study was done in rural population with diabetes to enlighten the sleep duration and quality. Results: 32 patients [64%] have good sleep latency. Sleep duration of 36 patients [72%] is more than 7 hours. Average duration of sleep of 50 patients is 7.56 hours. Habitual sleep efficiency is 0 in most patients [n=48(96%)]. Average time of onset of sleep is 10:24 PM and average time of getting up from bed is 5:10 AM. 84%(N=42) have a score of 1 in sleep disturbances. 65% of them get up in the middle of the night and 80% of them get up for using the toilet for micturition. 96% of patients did not use any sleep medication. Most patients [n=26(52%)] have score 2 i.e. fairly good quality of sleep. Conclusion: People of rural India have fairly good sleep quality. Their sleep latency is good. They have good sleep duration. Most have nocturia but have sleep without many disturbances. They have good habitual sleep efficacy. They do not take sleeping pills. They do not have daytime dysfunction. They have a good score PSQI.

Keywords: PSQI, type 2 diabetes, sleep in diabetes, rural India

1. Introduction

Chronic partial sleep loss due to bedtime restriction and sleep complaints are increasingly prevalent in modern society. During the past few years, evidence from laboratory and epidemiologic studies has accumulated, suggesting that decreased sleep duration and/or quality may adversely affect glucose regulation and increase the risk of type 2 diabetes mellitus.

Two published laboratory studies have reported alterations in glucose regulation during partial sleep restriction. In the first study, exposure to 5 days of 4-hour sleep durations was associated with a 40% reduction in glucose tolerance to intravenous glucose and a 30% reduction in the acute insulin response to glucose [1] These findings were confirmed in another study that used a randomized cross-over design with 2 nights of sleep restriction or extension (4-hour vs 10-hour bedtimes) [2]. After the second night of each condition, caloric intake was replaced by constant intravenous glucose infusion, and blood samples were collected every 20 minutes. After sleep restriction, morning glucose levels were higher and insulin levels were lower than after sleep extension [2]. Preliminary data from an ongoing study revealed a marked reduction in glucose tolerance and insulin sensitivity after 8 nights of 5-hour bedtimes compared with 8-hour bedtimes [3]. The consistency of these findings, despite differences in experimental design, suggests that sleep restriction has adverse effects on glucose metabolism.

A much larger number of epidemiologic studies, summarized in references from 4 to 14 have explored the relationship between sleep duration and/or quality and diabetes. The prospective studies, which involved different geographical locations, were remarkably consistent, indicating that short or poor sleep may increase the risk of developing type 2 diabetes. Evidence from cross-sectional studies suggests that a diabetic condition may involve a reduction in sleep duration or an impairment of sleep quality. Neuropathic pain and nocturia have been suggested as 2 possible causes of decreased sleep quality[14].

Normal average sleep duration was decreased from 8.0-8.9 hrs per night in 1960 to about 6.9-7.0 hrs in2000-2002[15, 16]. Poor sleep quality and insufficient sleep is commonly seen @ 46 – 69% [17-20].

Current evidence has shown that poor sleep quality is associated with increased risk of insulin resistance and obesity [21-24]. Furthermore, it is shown that poor sleep quality and short sleep duration increase the risk of diabetes [25-28]. A close relationship between diabetes and disturbed sleep has been proposed as the incidence of both disorders has increased during recent years [29-31]. Short sleep duration has been observed to be related to increased risk of diabetes [32, 33]. Difficulty initiating sleep, difficulty maintaining sleep and excessive daytime sleepiness are more common in diabetic patients [34, 35]. Nocturia and neuropathic pain have been proposed as possible causes of decreased sleep quality in diabetes [36].

With increasing incidence of diabetes in rural India due to urbanization, it is worth to study the sleep pattern in people with diabetes in rural India. So, the aim of the study was to enumerate the sleep quality in type 2 diabetes patients in rural INDIA.

2. Materials and Methods

A total of 50 people were enrolled with diagnosis of type 2 diabetes belonging to rural community in India.
Exclusion criteria were as follows;

Newly diagnosed type 2 diabetes with less than 1 year since diagnosis.

Type 1 diabetes
History of any systemic diseases such as anemia, thyroid disease, liver dysfunction, cardiovascular disease, pulmonary disease, renal impairment, stroke and peripheral vascular disease

Psychological disease and diagnosed sleep disorders need regular medical treatment

Restless leg syndrome,
Shift workers
Psychotropic and anticonvulsant drug users
History of treatment with opoids and routine use of benzodiazepines
Known diabetic complications on medical interventions, such as established peripheral neuropathy, diabetic neuropathy, diabetic nephropathy and retinopathy
Alcoholism and habitual smoking
Pregnancy and lactation

Study design
All the patients underwent an interview to record information on age sex and duration of diabetes. Hb1AC, and mean blood glucose.

At the end of the visit, each participant was asked to complete PSQI, a validated 19 questionnaire used to measure the quality and pattern of sleep in the past 1 month. It produces global quality score from 0 to 21, derived from seven components. The components include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and day time dysfunction. People with a global score equal or less than 5 are defined to have good sleep quality, while a global score more than 5 identifies those with poor sleep quality.

3. Results:

Age: Out of 50 patients taken into study, age distribution is as follows. Maximum number was in the age group 61 to 70 i.e 32% and minimum number was in the age group 21 to 30 i.e. 4%. Mean age is 51.36 years

| Age group | Number of patients |
|-----------|--------------------|
| 21-30     | 2 (4%)             |
| 31-40     | 10 (20%)           |
| 41-50     | 14 (28%)           |
| 51-60     | 8 (16%)            |
| 61-70     | 16 (32%)           |

Sex: 38 patients [76%] are males and 12 [24%] are females out of 50 patients enrolled.

Duration of diabetes: Duration varied from 2 yrs to 20 yrs. Distribution is as follows

| Duration in years | Number | Percentage |
|-------------------|--------|------------|
| 2-5               | 11     | 44%        |
| 6-10              | 11     | 44%        |
| 11-15             | 2      | 4%         |
| 16-20             | 1      | 2%         |

Average age of onset of diabetes 7.3 yrs.

PSQI:
Component 1: Most patients [n=26(52%)] have score 2 i.e. fairly good quality of sleep.
Component 2: 32 patients [64%] have good sleep latency.
Component 3: Sleep duration of 36 patients [72%] is more than 7 hours. Average duration of sleep of 50 patients is 7.56 hours.
Component 4: Habitual sleep efficiency is 0 in most patients [n=48(98%)]. Average time of onset of sleep is 10:24 PM and average time of getting up from bed is 5:10 AM.
Component 5: 84%[N=42] have a score of 1 in sleep disturbances. 65% of them get up in the middle of the night and 80% of them get up for using the toilet for micturition.
Component 6: 96% of patients did not use any sleep medication.
Component 7: Daytime dysfunction is not present in 60% [n=30] of patients. 24% had a problem in engaging in daytime activity. 36% had a problem to keep up enthusiasm to get things done.

Global score distribution is as follows:

| Global score | Number [n=50] | Percentage |
|--------------|---------------|------------|
| 0-5          | 40            | 80%        |
| 6-10         | 10            | 20%        |
| 11-15        | 0             | 0%         |
| 16-21        | 0             | 0%         |

The mean HbA1C level was 7.1 and 53% of patients had good glycemic control with an hbA1C value below 7.

3. Discussion

This study was done in patients completely of rural origin with agriculture as main profession. The effect of diabetes and disturbed sleep was independent of age and sex. As duration of diabetes increases sleep quality decreases. This is because the patients had enthusiasm to get things done and other medical conditions. Most patients sleep late and get up
early as suggested by the time. This is because of the agricultural background. Most patients have good sleep duration i.e. 7 hours. Most patients have no disturbance in sleep except for nocturia which was observed in 68%. Nocturia did not have any influence on quality of sleep. Use of sleep medication and day time dysfunction is not observed in most patients. PSQI global score in patients with diabetes in rural population is less than 5 which suggest good sleep quality. Conclusion:

This study was done in rural population with diabetes to enlighten the sleep duration and quality.

1) People of rural India have fairly good sleep quality.
2) Their sleep latency is good.
3) They have good sleep duration
4) Most have nocturia but have sleep without any disturbances.
5) They have good habitual sleep efficacy.
6) They do not take sleeping pills.
7) They do not have daytime dysfunction
8) They have a good score PSQI.

References

[1] Spiegel KL, Leproulle RV, Van Cauter E. Impact of sleep debt on metabolic and endocrine function. Lancet 1999;354:1435-1439
[2] Spiegel KK, Knutson KL, Egan BM, et al. Short sleep duration and increased mortality risk. Am J Epidemiol 2003;158:711-717
[3] Leproult R, De Lint M, Van Cauter E. Marked decrease in insulin sensitivity following one week of partial sleep deprivation with or without circadian misalignment. Diabetes 2006;55 (Suppl 1): A323 - A324
[4] Ayas NT, White DP, Al-Delaimy WK, et al. A prospective study of self-reported sleep duration and incident diabetes in women. Diabetes Care 2003;26:380-384
[5] Kawakami N, Takeda S, Shimizu H. Sleep duration and onset of type 2 diabetes. Diabetes Care 2004;27:2822-2828
[6] Nilsson P, Ronn T, Engstrom G. Incidence of diabetes in middle-aged men related to sleep disturbances. Diabetes Care 2004;27:2464-2469
[7] Mallon L, Broman J, Hetta J. High incidence of diabetes in men with sleep complaints or short sleep duration: a 12-year follow-up study of a middle-aged population. Diabetes Care 2005;28:2762-2767
[8] Bjorkelund C, Bondy C, Carlsson DL, et al. Sleep disturbances in midlife unrelated to 32-year diabetes incidence: the prospective population study of women in Gothenburg. Diabetes Care 2005;28:2762-2767
[9] Meisinger C, Heier M, Loewel H. Sleep disturbance as a predictor of type 2 diabetes mellitus in men and women from the general population. Diabetologia 2005;48:235-241
[10] Yaggi HK, Araujo AB, McKinlay JB. Sleep duration and as a risk factor for the development of type 2 diabetes. Diabetes Care 2006;29:657-661
[11] Gislason T, Almqvist M. Somatic diseases and sleep complaints: an epidemiological study of 3,201 Swedish men. Acta Med Scand 1987;221:475-481
[12] Hyypia T, Kronholm E. Quality of sleep and chronic illnesses. J Clin Epidemiol 1989;42:633-638
[13] Sridhar G, Raman H, Madhu K. Prevalence of sleep disturbances in diabetes mellitus. Diabetes Res Clin Pract 1994;23:183-186
[14] Lamond NT, Gavigan M, Dawson D. Factors predicting sleep duration in type 2 diabetes. Sleep 2000;23:415-418
[15] Martins RC, Andersen ML, Tutik S, et al. The reciprocal interaction between sleep and type 2 diabetes mellitus: facts and prospective. Braz J Med Biol Res 2008;41(3):180-7
[16] Kripke DF, Simons RN, Garfinkle L, Hammond EC. Short and long sleep and sleeping pills. Is increased mortality associated? Arch gen Psychiatry. 1979;36(1):103-16
[17] Terzano MG, Parino L, Cirignotta F, et al: insomnia in primary care, a survey conducted on the Italian population. Sleep Med 2004;5(1):67-75
[18] Walsh J, Benca R, et al. Insomnia assessment and management in primary care. Am Fam Physician. 1999;59(11):3029-3038
[19] Aikens JE, Rouse ME, et al. Help sleeping for insomnia among adult patients in primary care. J Am Board Fam Pract. 2005;18(4):257-61
[20] Shochat T, Umphress J, et al. Insomnia in primary care patients. Sleep 1999;22 suppl 2: s359-65.
[21] Gangwisch JE, Malaspina D, et al. Short sleep and obesity is a risk factor for obesity: analysis for the NHANES I. Sleep 2005;28(10):1289-96
[22] Hasler G, Buysse DJ, et al. The association between short sleep duration and obesity in young adults: a 13 year prospective study. Sleep 2004;27(4):661-67
[23] Knippen KL, Spiegel K, et al. The metabolic consequences of sleep deprivation. Sleep Med Rev 2007;11(3):163-78
[24] Lou P, Chen P, et al. Relation of sleep quality and sleep duration to type 2 diabetes; a population based cross sectional survey. BMJ open. 2012;2(4):e000956
[25] Brooks B, Cistulli P, Ba Obstructive sleep apnoea in obese non insulin dependent diabetes patients: effect of continuous positive airway pressure treatment on insulin responsiveness. J Clin Endocrinol Metab. 1994;79(6):1681-5
[26] Gottlieb DJ, Punjabi NM, et al. Association of sleep time with diabetes mellitus and impaired glucose tolerance. Arch intern med. 2005;165(8):863-7. Doi:10.1001/archinte.165.8.863
[27] Kita T, Yoshioka E, et al. Short sleep duration and poor sleep quality increase the risk of diabetes in Japanese workers with no family history of diabetes. Diabetes care. 2012;35(2):313-8. Doi:10.2337/dc11-1445
[28] Hayashino Y, Fukuhara S, et al. Relation between sleep duration and diabetes. Diabetes Res Clin Pract 1996;38:41-47.
[29] Spiegel K, Knutson K, et al. A novel risk factor for insulin resistance and type 2 diabetes. J Appl Physiol. 2005; 99[5]:2008-19

[30] Vancauter E, Polonsky KS, et al. Roles of circadian rhythm and sleep in human glucose regulation. Endocr Rev. 1997; 18[5]:716-38

[31] Resnick HE, Redline S. Diabets and sleep disturbances: finding from the sleep heart health study. Diabetes care. 2003; 26[3]: 702-9.

[32] Sreedher GR, Madhu K. Prevalence of sleep disturbances in diabetes mellitus. Diabetes Res Clin Pract. 1994; 23[3]: 183-6.

[33] Scheen AJ, Byrne MM. Relationships between sleep quality and glucose regulation in normal humans. Am J Physiol. 1996; 271[2 pt 1]: e261-70.

[34] Ayas NT, White DP, et al. A prospective study of self-reported sleep duration and incident diabetes in women. Diabetes care. 2003; 26[2]: 380-4.

[35] Gislaon T, Almqvist M, et al. Somatic diseases and sleep complaints and epidemiology study of 3201 Swedish men. Acta Med Scand. 1987; 221[5]: 475-81.

[36] Meier U, Gressner AM. Endocrine regulation of energy metabolism: review pathobiocchemical and clinical chemical aspects of leptin, ghrelin, adiponectin, and resistin. Clin chem. 2004; 50[9]: 1511-25.

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