Original Research Article

A cross sectional study on obstructive sleep apnea in patient with type 2-diabetes mellitus

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Abstract

Introduction: Sleep apnea is a sleep disorder characterized by pauses in breathing or periods of shallow breathing during sleep. Diabetes mellitus (DM) and obstructive sleep apnea (OSA) are common disorders that often coexist. Risk factors for OSA include being overweight and obesity, a family history of the condition, allergies, a small airway, and enlarged tonsils. **Objectives:** This study was carried out to check whether patient with diabetes are at risk of developing sleep apnea or not. **Material and method:** In this cross sectional study, participants were selected on the basis of inclusion criteria. A total of 150 patients with type 2 diabetes mellitus having HbA_1c level more than 7% where considered in this study. Aseptically, venous blood was drawn from the antecubital vein from each patient for estimation of HbA1c. HbA1c was estimated by using Nycocard Reader. While, Polysomnography was done for diagnosis of OSA which is consider as gold standard at department of pulmonary medicine. Statistical analysis of collected data has been determined by using SPSS (16.0). P value < 0.05 was considered as statistically significant. **Result:** Patients having high average BMI and Neck Circumference is having greater number of sleep apnea (51- 60).This study also revel high percentage of HbA1c is directly related to Sleep apnea. **Conclusion:** Our study involved low number of cases but still the results were satisfying; the incidence of OSA was significantly higher in Diabetes mellitus patients as comparison to general population. Early detection and treatment of OSA in DM patients can prevent development of complications in them due to the combined effects of both diseases.

Keywords: Diabetes Mellitus, Sleep Apnea, BMI, Polysomnography, Nycocard

Introduction

Sleep apnea is a sleep disorder characterized by pauses in breathing or periods of shallow breathing during sleep[1]. There are three forms of sleep apnea obstructive (OSA), central (CSA), and a combination of the two called mixed. Among these three types of sleep apnea obstructive sleep apnea is the most common form[2]. Many authors had suggested obstructive sleep apnea (OSA) is a treatable sleep disorder characterized by repetitive upper airway collapse, leading to oxygen desaturation and sleep fragmentation[3]. Whiletype-2 diabetes mellitus develops gradually without any specific symptoms and is characterized late only once the other conditions affect various organs[4-5]. Diabetes cases are increasing in the modern world due to an increasing prevalence of obesity and sedentary lifestyle[6-7]. Diabetes mellitus (DM) and obstructive sleep apnea (OSA)are common disorders that often coexist. Risk factors for OSA include being overweight and obesity, a family history of the condition, allergies, a small airway, and enlarged tonsils[2]. There may also be a more complex relationship between these conditions in which an underlying metabolic disorder predisposes for both or in which metabolic and autonomic abnormalities associated with one, influence the development of the other because both diabetes and OSA are associated with increased cardiovascular morbidity and mortality. Sleep apnea is present in 9%-24% of the middle aged adult population[3]and has been associated with increased rates of hypertension, atherosclerosis, cardiovascular morbidity and mortality (including stroke), and all-cause mortality[8,9,10,11,12]. OSA has been identified as a highly prevalent comorbidity oftype 2 diabetes mellitus (DM)[8,9,10].

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OSA has also been identified as ahighly prevalent co-morbidity of type 2 diabetes mellitus(DM), in particular, among obese patients with type 2DM, which represent the vast majority of individuals with type 2 DM[13-14]. In the western population the prevalence of OSA in the middle aged (30 to 60 years) is 4% in men and 2% in women[15]. The prevalence of type 2 diabetes continues to increase in the US, and currently affects an estimated 18 million people[16]. However, very little literature is available about the prevalence of OSA in Indian population. A study done in Delhi estimated the prevalence of OSA and OSAHS in an Indian study population to be 13.7% and 3.6% respectively[17-18]. Previous studies showed that reduction of sleep duration or decreased sleep quality impair glucose tolerance and reduce insulin sensitivity in healthy controls[19-20]. Therefore, to know degree of Sleep apneaPolysomnography method was considered which is a gold standard for diagnosis of OSA. Therefore based on the above consideration this study was done to evaluate diabetes and sleep apnea. Early diagnosis and treatment of this disease can prevent the potential complications of the disease.

Material and method

In this cross sectional study, participants were selected on the basis of inclusion criteria. This study was conducted for 1 year. A total of 150patients with type 2 diabetes mellitus having HbA_1c level more than 7% where taken in this study. Out of which 50 were male and 100were female. Patients were identified by the principal investigator following inclusion criteria at the department of pulmonary medicine.Complete history and physical examination were takento confirm diagnosis. If patients met the inclusion criteria, informed consent was taken after explaining to him or her about the study. Aseptically, venous blood was drawn from the antecubital vein from each patient for estimation of HbA1c.The blood samples were then transported to the central laboratory within an hourof collection for analysis. HbA1c was estimated by using Nycocard Reader. While, Polysomnography wasdone for diagnosis of OSA which is consider as

gold standard. Statistical analysis of collected data has been determined by using SPSS (16.0). P value < 0.05 was considered as statistically significant.

Inclusion Criteria

1. Patient having the history of diabetes mellitus.
2. Patient having HbA1c level >7%.
3. Patient above 30 years.

Exclusion Criteria

The patient with:

1. Cardiac disease
2. Chronic kidney disease
3. Gastroenteritis
4. Patient using sleeping pills and
5. Patients who are on drugs which can cause bradycardia/trachycardia were excluded from the study

Result

Table-1: Showing total number Patient with diabetes in different age groups

Sl. No	Age	Number of Patients with Diabetes
01.	31-40	41
02.	41-50	34
03.	51-60	52
04.	61-70	23

Table representing total number of patient with type 2-diabetes per age groups which shows, 41 patients in the age group between (31-40), 34 patients in age group between (41-50), 52 patients in the age group between (51-60) and 23 patients in the age group between (61-70).

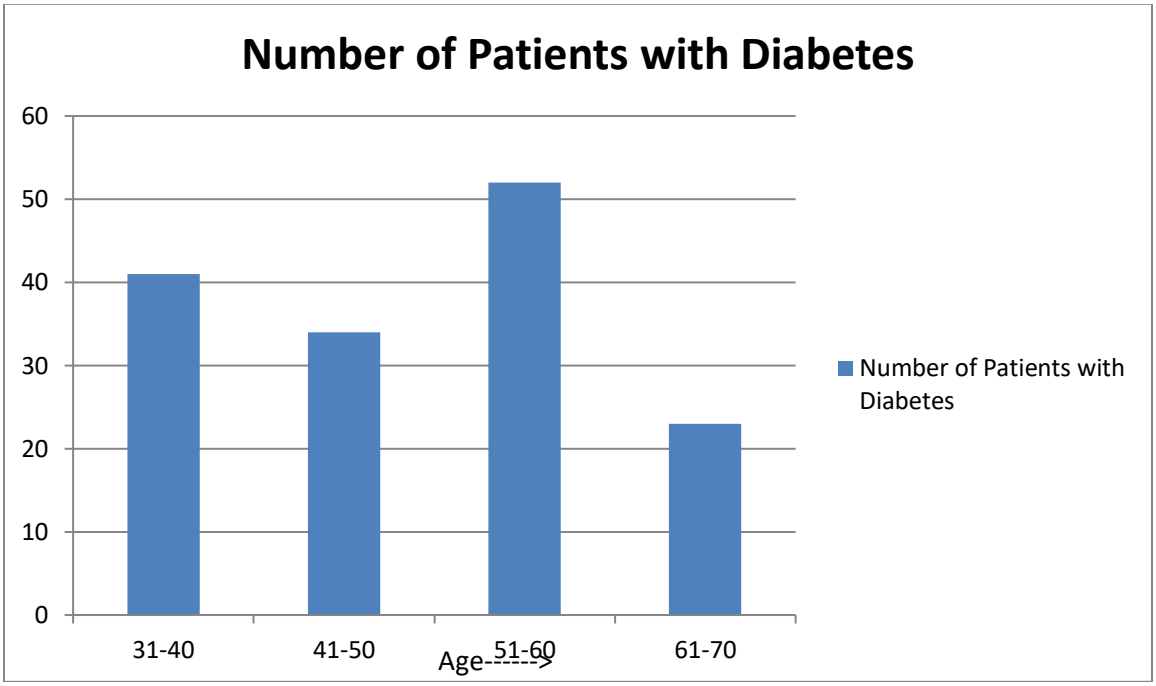

Figure-1: **Representing total number Patient with diabetes in different age groups**

Table-2: Showing total number of patient having sleep apnea, confirmed through Polysomnography.

Sl. No.	Age	Number of patient with Diabetes	Patient having Sleep apnea.	% showing patient with sleep apnea within a define age groups
01.	31-40	41	11	26.8
02.	41-50	34	16	47.0
03.	51-60	52	27	51.9
04.	61-70	23	14	60.8
	Total	**150**	**68**	**45.33%**

Table showing total number of patient having sleep apnea and its percentage within a define age group.

Table-3: Showing patient having sleep apnea with BMI and Neck Circumference

Age	Patient having Sleep Apnea.	Average BMI Mean±SD kg/m^2	Average Neck circumference Mean±SD
31-40	11	26 ±2.1	12 ± 1.3
41-50	16	33±2.9	17 ± 1.5
51-60	27	36±3.3	18 ± 1.7
61-70	14	27±2.7	15 ± 2.4
Total	**68**		

Table shows patient group having high average BMI and Neck Circumference is having greater number of sleep apnea (51- 60)

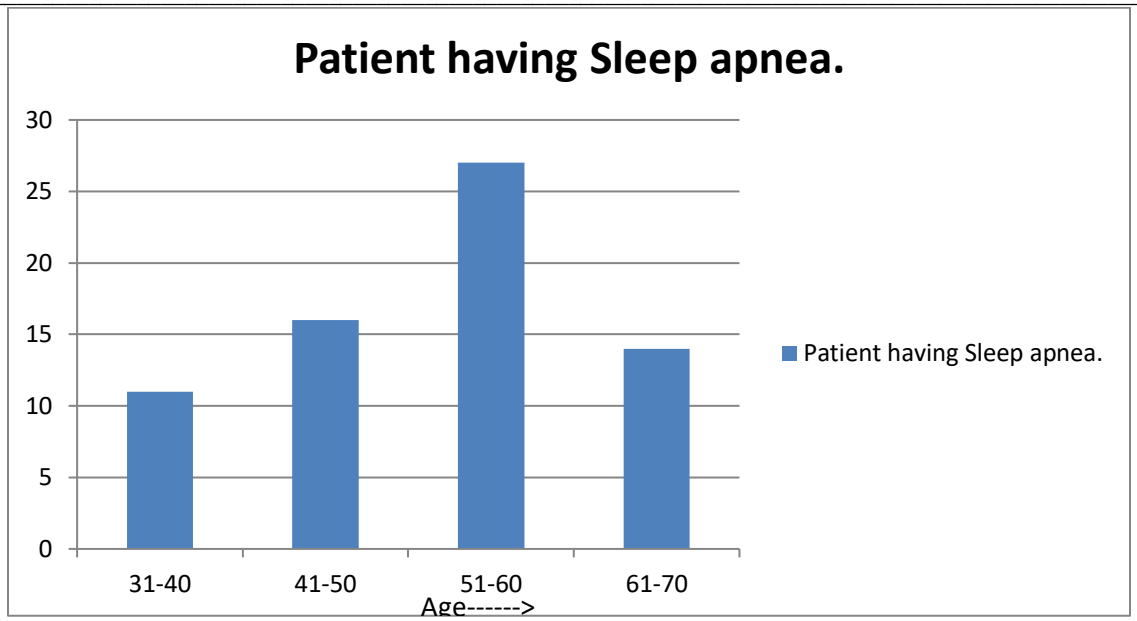

Figure-2: Representing total number of patient having sleep apnea.

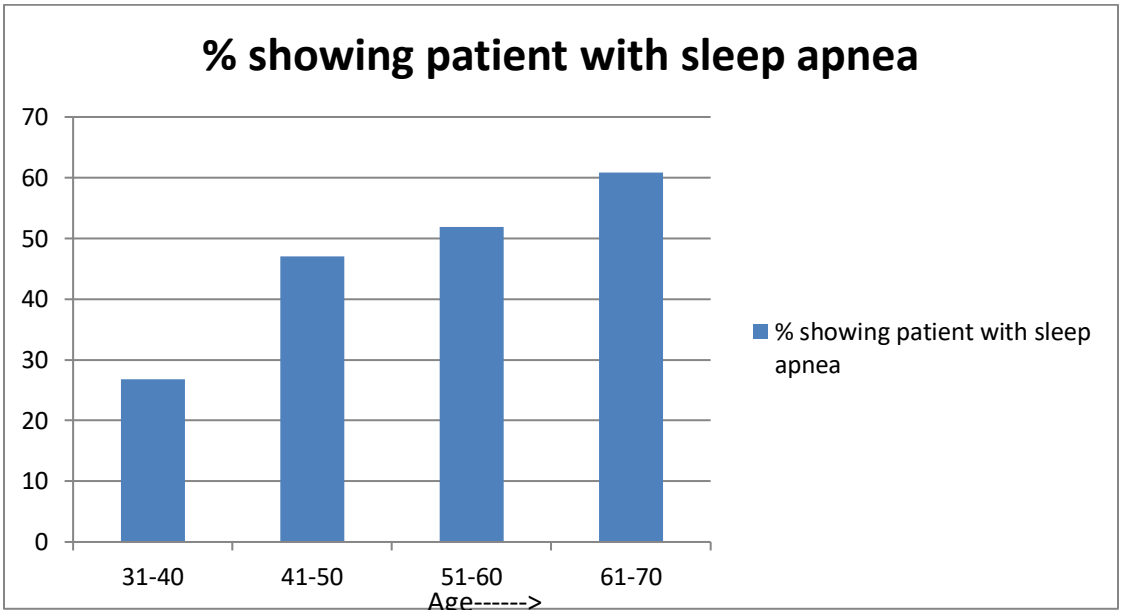

Figure -3: Representing total %f patient having sleep apnea in define age groups.

Discussion

Sleep apnea is a sleep disorder characterized by pauses in breathing or periods of shallow breathing during sleep. There are three forms of sleep apnea, obstructive (OSA), central (CSA), and combination of the two called mixed. Among these three types of sleep apnea obstructive sleep apnea is the most common form. Diabetes mellitus (DM) and obstructive sleep apnea (OSA) are common disorders that often coexist. Risk factors for OSA include being overweight and obesity, a family history of the condition, allergies, a small airway, and enlarged tonsils[2]. Based on the above consideration this study was carried out to check whether patient with diabetes are at risk of developing sleep apnea or not. This study was carried out for around 1 year in the department of pulmonary medicine. Total number of 150 patients were examined for sleep apnea which was found to be total number of 68 patient having sleep apnea with a percentage of 45.33%.

In this study patient having high number of diabetes was in the age group of (51-60) having 52 patients and list number of patients were 23 in the age groups of (61-70).Similar high prevalence of OSA up to 77% was reported in another clinical based study including 60 subjects with diabetes[21]. Our study shows high prevalence of sleep apnea with increase age group which is similar to the sleep heart health study involving older DM individuals found OSA prevalence of 58%, which is consistent with our study[15]. Our study has demonstrated a high prevalence of OSA in patients with DM. Many studies have proved the association of various co-morbidities in OSA with DM. It has also been proven that the prevalence of OSAis higher in patients with DM than in the general population or in obese non-DM subjects[22]. On the other hand our study also demonstrate patient having high BMI show high prevalence of sleep apnea. This is similar to the study by Young et al[23]., which showed that a 1-SD

increase in BMI was associated with a four-fold increased risk for prevalent sleep apnea, and they demonstrated a sleep apnea prevalence of approximately 40% in moderately overweight men from the community who were otherwise healthy. In severe obesity (BMI >40 kg/m2), the prevalence of sleep apnea was estimated to vary between 40 and 90%, and the severity of sleep apnea was generally greater than that found in leaner clinical populations. Peppard et al[24]., have provided further evidence for a link between sleep apnea and obesity by demonstrating that a 10% change in body weight was associated with a parallel change of approximately 30% in the apnea hypopnea index (AHI), the major index of sleep apnea severity. One of the hypotheses proposed to explain this increased risk has been that excess adipose tissue around the upper airway increases neck circumference and presents mechanical challenges for the lumen of the pharynx to stay patent during sleep[25]. Similarly according to our study sleep apnea is high with increase in HbA1c value. This is similar to the study of Aron-sohn et al[26]., measured HbA1c in 60 consecutive patients with diabetes. OSA (AHI >5) was present in 77% of patients with type 2diabetes and 38% of the patients had moderate or severe OSA (AHI >15). Compared with patients without OSA, the adjusted mean HbA1C was increased by 1.49% in patients with mild OSA, 1.93% in moderate OSA, and 3.69% in severe OSA. Therefore, from the observation we can conclude patient with uncontrol glucose level, abnormal BMI and increased neck circumference can be a good indicator to predict patient who can develop sleep apnea which can cause adverse effect to livelihood.

Conclusion

Our study involved low number of cases but still the results were satisfying; the incidence of OSA was significantly higher in Diabetes mellitus patients in comparison to general population. There was a significant association of co-morbidities between OSA and diabetes mellitus individually and in combination. Early detection and treatment of OSA in DM patients can prevent development of complications in them due to the combined effects of both diseases. Thus, the need for screening DM patients for undiagnosed OSA has been reinforced by this study. In summary, sleep apnea is significantly associated with the risk of type 2 diabetes, independently of other risk factors, including age, race, sex, baseline fasting glucose, BMI, and changes in BMI. Increased severity of sleep apnea is associated with an increased risk of diabetes and vice versa.

Reference

1. Jung R, Kuhlo W. Neurophysiological studies of abnormal night sleep and the Pickwickian syndrome. InProgress in brain research 1965 Jan 1 (Vol. 18, pp. 140-159).
2. Fishman AP, Elias JA in Fishman's Pulmonary Diseases and Disorders. 2008; 97:1571.
3. Einhorn D, Stewart DA, Erman MK, Gordon N, Philis-Tsimikas A, Casal E. Prevalence of sleep apnea in a population of adults with type 2 diabetes mellitus. *EndocrinolPract*2007;13:355-62.
4. Harris MI, Klein R, Welborn TA, Knuiman MW. Onset of NIDDM occurs at least 4–7 years before clinical diagnosis. Diabetes Care.1992; 15: 815-19.
5. Zimmet PZ. The pathogenesis and prevention of diabetes in adults. Diabetes Care. 1995; 18: 1050-64.
6. Diabetes Fact Sheet, WHO. [Internet] [Cited November 2008]. Available from: http://www.who.int/mediacentre/factsheets/fs312/en.
7. V. Lambadiari, P.Mitrou, E. Maratou et al. Thyroid hormones are positively associated with insulin resistance early in the development of type 2 diabetes. Endocrine. 2011; 39(1): 28-32.
8. Helfand M, Crapo LM. Screening for thyroid disease. *Ann Intern Med*. 1990;112:840–9.
9. Danese MD, Powe NR, Sawin CT, Ladenson PW. Screening for mild thyroid failure at the periodic health examination: a decision and cost-effectiveness analysis. *JAMA*. 1996;276:285–92.
10. Dayan CM, Daniels GH. Chronic autoimmune thyroiditis. *N Engl J Med*. 1996;335:99–107.
11. Franklyn JA, Daykin J, Drolc Z, Farmer M, Sheppard MC. Long-term follow-up of treatment of thyrotoxicosis by three different methods. *ClinEndocrinol [Oxford]*. 1991;34:71–6.
12. Tamai H, Kasagi K, Takaichi Y, Takamatsu J, Komaki G, Matsubayashi S, et al. Development of spontaneous hypothyroidism in patients with Graves' disease treated with antithyroidal drugs: clinical, immunological, and histological findings in 26 patients. *J ClinEndocrinolMetab*. 1989;69:49–53.
13. Foster GD, Sanders MH, Millman R, Zammit G, Borradaile KE,Newman AB, et al., Sleep AHEAD Research Group. Obstructive sleep apnea among obese patients with type 2 diabetes. *Diabetes Care*2009;32:1017-19.
14. Punjabi NM, Shahar E, Redline S, Gottlieb DJ, Givelber R, Resnick HE. Sleep-disordered breathing, glucose intolerance, and insulin resistance: the Sleep Heart Health Study. *Am J Epidemiol*2004;160:521-30.
15. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep disordered breathing in middle-aged adults. *N Engl J Med* 1993;328(17):1230-5.
16. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care*. 2005;28 : S37-S42.
17. Sharma SK, Kumpawat S, Banga A, Goel A. The prevalence and risk factors of obstructive sleep apnea syndrome in a population of New Delhi, India. *Chest* 2006;130:149-56.
18. Rosenthal MJ, Hunt WC, Garry PJ, Goodwin JS. Thyroid failure in the elderly. Microsomal antibodies as discriminant for therapy. *JAMA*. 1987;258:209–13.
19. Donga E, van Dijk M, van Dijk JG, Biermasz NR, LammersGJ,vanKralingen K, et al. Partial sleep restriction decreases insulin sensitivity in type 1 diabetes. Diabetes Care. 2010;33:1573---7.11
20. Van Dijk M, Donga E, Van Dijk JG, Lammers GJ, Van KralingenKW, Dekkers OM, et al. Disturbed subjective sleep charac-teristics in adult patients with long-standing type 1 diabetesmellitus. Diabetologia. 2011;54:1967-76.
21. Aronsohn RS, Whitmore H, Van Cauter E, Tasali E. Impact of untreated obstructive sleep apnea on glucose control in type 2 diabetes. *Am J RespirCrit Care Med* 2010;181:507-13.
22. Coughlin SR, Mawdsley L, Mugarza JA, et al. Obstructive sleep apnoea is independently associated with an increased prevalence of metabolic syndrome. *Eur Heart J* 2004;25:735.
23. Young T, Shahar E, Nieto FJ, Redline S, Newman AB, Gottlieb DJ, *et al.* Predictors of sleep disordered breathing in community dwelling adults: the sleep heart health study. *Arch Intern Med* 2002;162:893-900.
24. Peppard PE, Young T, Palta M, Dempsey J, Skatrud J. Longitudinal study of weight change and sleep disordered breathing. *JAMA* 2000;284:3015-21.
25. Riha RL, Brander P, Vennelle M, McArdle N, Kerr SM, Anderson NH, *et al.* The relationship between obesity and craniofacial structure in obstructive sleep apnea. *Chest* 1995;108:375-81.
26. Aronsohn RS, Whitmore H, Van Cauter E, Tasali E. Impact of untreated obstructive sleep apnea on glucose control in type 2 diabetes. *Am J RespirCrit Care Med* 2010;181:507-13.

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