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A Cross-Sectional Study to Assess the Prevalence of Risk of Obstructive Sleep Apnea in Patients with Type 2 Diabetes Mellitus in Tertiary Care Hospitals, Western Maharashtra

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Abstract: ***Background: Diabetes and obstructive sleep apnea (OSA) are bidirectionally related to each other. The presence of Type 2 Diabetes Mellitus seems to put the patient at high risk of OSA. Therefore, the study is aimed to find the prevalence of risk of OSA among Type 2 Diabetes Mellitus patients in tertiary care hospital of Western Maharashtra. Material and methods: A cross-sectional study was conducted in the OPDs of tertiary care hospitals. Consecutive sampling technique was used to select 300 study subjects with Type 2 Diabetes Mellitus based on the inclusion and exclusion criteria. Sociodemographic data was collected. Biophysical parameters recorded include Body Mass Index (BMI), neck circumference, Blood pressure and recent HbA1c values. Berlin questionnaire was administered to the study subjects as a screening tool to identify high risk OSA cases. Results: Among 300 study subjects, 120 subjects (40%) were in the age group of 51-60 years of age, 192 (64%) cases were females, 212 subjects (70.7%) were diagnosed as a case of Type 2 DM since >5-10 years, 146 subjects (48.7%) had hypertension and 255 cases (81.3%) were under the treatment regime of oral hypoglycemic agents. The prevalence of high risk of OSA was found to be 59% (177 cases) among 300 study subjects. Statistical association showed significant association of Gender with prevalence of risk of OSA. The mean BMI of high risk OSA cases was 27.61±4.35kg/m^2 and had a statistically significant association with prevalence of risk of OSA. HbA1c value also showed significant association with prevalence of risk of OSA (mean HbA1c among high risk OSA cases= 7.87±1.27%). Conclusion: The prevalence of risk of OSA is increased in patients with DM. Most of these patients exhibited no typical clinical symptoms of OSA and would have been undiagnosed without diagnostic screening assessment of OSA. Thus, screening questionnaires for OSA would help the health care workers to identify the patient with high risk OSA and provide referral of high risk OSA cases to the Sleep medicine department for polysomnography to confirm the diagnosis of OSA and thereafter get appropriate treatment as early as possible. Recommendations: Large scale studies in collaboration with sleep medicine department can be conducted to draw more definite conclusions and make generalizations and all diabetic patients should be followed up and care givers to be educated to identify signs of OSA and access health care facilities as early as possible.***

Keywords: Obstructive sleep apnea, Type 2 diabetes mellitus, Berlin questionnaire

1. Background of the Study

Sleep-disordered breathing (SDB) is an abnormal breathing pattern during sleep[3] that is often quantified as the apnea-hypopnea index (AHI)[2] and are of two types: Obstructive Sleep Apnea (OSA, 85%) and Central Sleep Apnea (CSA).The word 'apnea' has been derived from a Greek word meaning 'breathless' or 'loss of breath'.[3]The term 'Obstructive Sleep apnea' was first described by Charles Dickens as Pickwickian syndrome in 1837.

"Obstructive sleep apnea (OSA) is a respiratory disorder related to sleep disturbances characterized by sleep-related collapse of the pharynx which occurs because of persistent ineffective breathing efforts leading to repetitive interruptions of ventilation during sleep resulting in reduced oxygen supply to tissues. This hypoxemia is dealt by the body causing repeated sleep fragmentation".[5] resulting in oxidative stress and hyper somnolence during daytime.[6]

According to the study "Global Prevalence of Obstructive Sleep Apnea" conducted by an international panel of researchers, the prevalence of OSA impacts more than 936 million people worldwide i.e. 12.3% out of 7.6 billion population of the world.[7]

In a study conducted by Pinto AM et al (2018) among rural Indian population revealed that the prevalence of risk of OSA was 8.72% identified through Berlin questionnaire&3.74% through polysomnography.[8]Another cross-sectional study conducted by Joshi JM (2015) among 1188 subjects in Mumbai revealed that 6.4% of the adult population suffered from snoring and prevalence of OSA was 3.42% in the study population. This suggested that about 34 million people in India may be suffering from OSA.[9]

The risk of OSA can be screened using various questionnaires- Epworth Sleepiness Scale (ESS), the STOP Questionnaire (Snoring, Tiredness, Observed Apnea, High Blood Pressure), STOP-Bang Questionnaire (STOP Questionnaire plus BMI, Age, Neck Circumference, and Gender), Berlin questionnaire and the Wisconsin Sleep Questionnaire.[2, 12] The gold standard clinical diagnosis of OSA is done using Polysomnography.[13]

Treatment of OSA includes behavioural approaches to improve sleep habits, weight control[14] avoiding supine positions during sleep, smoking cessation, avoiding alcohol and other sedatives.[15] In severe forms of OSA, treatment includes mechanical measures like Continuous Positive Airway Pressure (CPAP)[14, 15]and dental appliances.[2]Surgical interventions like uvulo-palato-pharyngoplasty, craniofacial reconstruction and tracheostomy are also performed.[15]

OSA has often been associated with other disorders like diabetes mellitus[14], obesity[16] and hypertension, [17] the most

common being DM[14] which may be due to the presence of shared risk factors such as obesity[14] and has an increased cardiovascular morbidity and mortality rates.[18]

The relationship between OSA and Type 2 DM is bidirectional: Type 2 DM is a risk factor for OSA and OSA is a risk factor for Type 2 DM.[19]In patients with OSA, when airway is blocked temporarily, hypoxic episodes and sleep fragmentation occurs. This causes several hormonal changes leading to activation of the sympathetic nervous system and increase in the release of catecholamines. This in turn leads to glycogenesis and decrease in insulin sensitivity.[19]Moreover, there is a stimulation of hypothalamic-pituitary-adrenal axis (HPA axis) which causes an increase in the levels of cortisol and can further impair glucose metabolism by decreasing insulin release from the pancreas. Oxidative stress and inflammatory markers (i.e. Tumor Necrosis Factor α, Interleukin-6) play an important role in the surge of inflammatory processes which ultimately leads to metabolic syndrome.

2. Need of the Study

There are many adverse outcomes associated with OSA: Excessive daytime sleepiness, Impaired cognitive and neuropsychological functioning, [2] reduced quality of life, [33]occupational and motor vehicle accidents, [33]hypertension, [31] brady- and tachyarrhythmias, coronary artery disease and myocardial ischemia, cerebrovascular accidents, cardiomyopathy/congestive heart failure, pulmonary hypertension, increased overall mortality, insulin resistance.[9]

Both diabetes and OSA are associated with increased cardiovascular morbidity and mortality, therefore, if both these conditions co-exist it may result in greater health risks. For these reasons, it is important to create awareness of signs and symptoms of OSA in diabetic patients.[23] Currently, there is a lack of evidence to support the benefits of screening every diabetic patient for OSA.[34]

3. Aim

To assess the prevalence of risk of obstructive sleep apnea in patients with Type 2 Diabetes Mellitus in a tertiary care hospital

Objectives

Primary objective

- To assess the prevalence of risk of obstructive sleep apnea in patients with Type 2 Diabetes Mellitus.

Secondary objective

- To find the association of prevalence of risk of OSA with selected sociodemographic variables and biophysical parameters in patients with Type 2 Diabetes Mellitus

Hypotheses

Null hypothesis (H_0)

$H_{0(1)}$: There is no association of prevalence of risk of Obstructive Sleep Apnea with selected sociodemographic variables.

$H_{0(2)}$: There is no association of prevalence of risk of Obstructive Sleep Apnea with biophysical parameters.

Alternate hypothesis (H_1)

$H_{1(1)}$: There is a significant association of prevalence of risk of Obstructive Sleep Apnea with selected sociodemographic variables.

$H_{1(2)}$: There is a significant association of prevalence of risk of Obstructive Sleep Apnea with biophysical parameters.

Ethical Considerations

Permission from the institutional ethical committee was obtained in writing, prior to the conduction of research. Confidentiality of the participants was maintained by coding the samples and written informed consent was taken from all the participants.

4. Review of Literature

Extensive review of literature - articles from 2010 to 2019. It is discussed under the following:

- Obstructive Sleep Apnea
- Relationship between OSA and Type 2 DM
- Prevalence of OSA in Type 2 DM patients

In-depth literature review reveals that there is a moderately high prevalence of OSA among diabetic individuals. Factors increasing the risk of OSA include obesity, increased neck circumference, hypertension, male gender and altered blood glucose levels. The researcher could identify various screening questionnaires to identify the risk of OSA. Thus, the literature review helped the researcher to find the past, present and future aspects of the research problem and plan the study.

5. Obstructive Sleep Apnea

Respiratory sleep related disorder causes repetitive interruptions of ventilation during sleep and arterial hypoxemia.[4,] According to the International Sleep Experts Estimate, published on May 2018, the prevalence of OSA is nearly 936 million worldwide[5]

Risk factors are male gender, [2]obesity, [1]central (abdominal) obesity, neck circumference, hypertrophied tonsils, tongue, [6]nasal congestion.[6]

Screening tests for OSA are Berlin questionnaire [7], STOP BANG questionnaire (Snoring, Tiredness, Observed

Apnea, High Blood Pressure plus BMI, Age, Neck circumference and Gender) [7], Epworth Sleepiness Scale (ESS) [7], Wilconsin Sleep Questionnaire.[7]and confirmatory test is polysomnography [2]

OSA & Type 2 DM

Type 2 DM is a risk factor for OSA and vice versa.[1] OSA induces insulin resistance by arousals, oxygen desaturations, and other unknown factors.[8] Wilding J (2018) in his article on "Diabetes and Obstructive Sleep Apnea syndrome" stated that obstructive sleep apnea is commonly associated with type 2 diabetes and is associated with higher risk of complications[9]

Algeffari M et al (2018) conducted a cross-sectional study to find out the prevalence of OSA among 201 adults with Type 2 DM in Saudi Arabia and were administered Berlin Questionnaire. Prevalence of high risk of OSA was 44.3%[10]

Edmonds PJ et al (2018) conducted a prospective study to identify OSA in Type 2 DM patients comparing neck grasp, neck circumference and common screening questionnaires i.e. Easy Sleep Apnea Predictor (ESAP), STOP-Bang questionnaire, and Berlin questionnaire.43 subjects were included in the study and all underwent polysomnography. The prevalence of OSA was 90.7%[11]

Malik JA et al (2017) conducted a study to find out the association between OSA and Type 2 DM. Epworth Sleepiness Scale (ESS) and polysomnography was done for 62 diabetic patients. The study revealed that 03 patients had mild OSA, 28 had moderate OSA and 28 had severe OSA[12]

6. Methodology

A cross-sectional study was conducted in the OPDs of tertiary care hospitals. Consecutive sampling technique was used to select 300 study subjects with Type 2 Diabetes Mellitus based on the inclusion and exclusion criteria. Sociodemographic data was collected. Biophysical parameters recorded include Body Mass Index (BMI), neck circumference, Blood pressure and recent HbA1c values. Berlin questionnaire was administered to the study subjects as a screening tool to identify high risk OSA cases.

Inclusion criteria

- Patients with Type 2 DM diagnosed for more than 05 years
- Age >30 to 70 years
- Patients able to read and understand Hindi or English or Marathi

Exclusion criteria

- Acute and unstable medical condition e.g. Congestive Heart Failure, Chronic Renal Failure, Chronic Obstructive Pulmonary Disease.
- Recent stroke, Acute coronary syndrome, Pregnant women
- Mechanical Obstructive airway, e.g. Nasal septum deviation, Nasal or Oral Polyps, any surgical intervention of the airways
- Known case of Obstructive Sleep Apnea

7. Data Analysis and Interpretation

The analysis was done using SPSS software version 21. Demographic variables were represented with numbers and percentage. Chi square test, Fisher exact test and Unpaired 't' test were used to find the association between risk of OSA & demographic variables and biophysical parameters. A 'p' value < 0.05 was considered significant.

Table 1: Distribution of study subjects as per socio-demographic data

Parameters		No of cases	Percentage
Age (Years)	31 – 40	19	6.3
	41 – 50	59	19.7
	51 – 60	120	40
	61 – 70	102	34
Sex	Male	108	36
	Female	192	64
Marital status	Married	265	88.3
	Divorced / separated	2	0.7
	Widowed	31	10.3
	Unmarried	2	0.7
Comorbidity	Hypertension	146	48.7
	Cardiac diseases	6	2
	Respiratory diseases	1	0.3
	GI problem	7	2.3
	Others	35	11.7
	None	61	20.3
	Combined	44	14.7
Treatment regime	OHA	255	81.3
	Insulin	13	4.3
	Combined	43	14.3

Duration of Type 2 DM (Years)	>5 – 10 11 – 15 16 – 20 >20	212 48 20 20	70.7 16 6.7 6.7
Smoking	Yes No	16 284	5.3 94.7
If yes, how many cigarettes / day (n=16)	≤3 4 & above	9 7	56.25 43.75
Alcohol	Yes No	10 290	3.3 96.7
If yes how much / day (n=10) (ml)	Occasional 30 – 90 >90ml	5 2 3	50 20 30
Family H/O Type 2 DM	Yes No	151 148	50.3 49.7

Table 4.2: Distribution of study subjects as per biophysical parameters

n=300

Parameters		No of cases	Percentage
BMI (kg/m^2)	<18.5 18.5 – 24.99 25 – 29.99 30 & above	2 114 119 65	0.7 38 39.7 21.7
Systolic Blood Pressure (mmHg)	<120 120 – 139 140 – 159 160 & above	46 122 94 38	15.3 40.7 31.3 12.7
Diastolic Blood Pressure (mmHg)	<80 80 – 89 90 – 99 100 & above	90 110 70 30	30 35.7 23.3 10
Neck circumference (cm)	30 – 35 36 – 40 >40	163 122 15	54.3 40.7 5
HbA1c (%)	<6.5 6.5 – 6.99 7 – 7.49 7.5 & above	64 41 50 145	21.3 13.7 16.7 48.3

Descriptive statistics was used to describe the prevalence of Obstructive Sleep Apnea risk and inferential statistics like Chi square test, Fisher exact test and Unpaired 't' test at 5 % level of significance were used to determine the association between prevalence of Obstructive Sleep Apnea risk and selected demographic variables and biophysical parameters. The analysis showed the prevalence of Obstructive Sleep Apnea risk was high in 59% of the study subjects. There was a significant association of biophysical parameters like BMI, blood pressure and HbA1c values with increased risk of OSA except for neck circumference and there was no significant association of sociodemographic variables with risk of OSA except for gender of the study subjects.

8. Discussion

In the present study, prevalence of high risk of OSA was 59% among 300 diabetic patients. Similar study conducted by Algeffari M et al (2018) among 201 adults with Type 2 DM in Saudi Arabia found out that the prevalence of high risk OSA cases was 44.3.%.[10]However, in contrast to the present research, a study conducted by Viswanathan V et al (2017) in a tertiary care centre found that the prevalence of OSA was only 23.65%.[2]

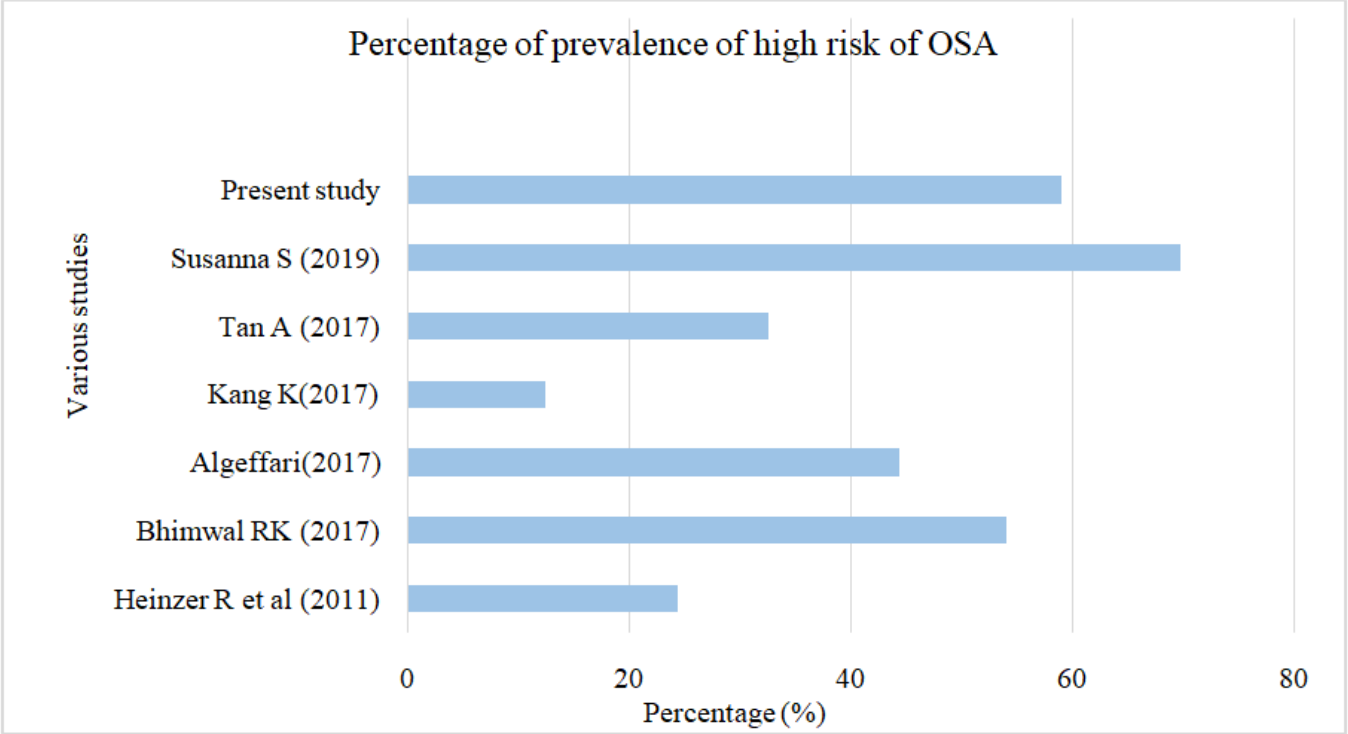

Figure 1: Various studies showing prevalence of high risk of OSA

In the present study, 70.63% of the samples were females among 177 high risk OSA study subjects and it indicates that females were significantly associated with high risk OSA cases as p< 0.05 (p=0.004). This study was in contrast with the findings of a study by Bhimwal RK et al (2017) where prevalence of OSA was 64.29% in males and 40.91% in females.[14]Another study also had conflicting findings with the present study conducted by Algeffari M et al where 51.7% were males among 89 high risk OSA cases (p=0.716)[10]

In the present study, mean BMI of high risk OSA cases was 27.61kg/m^2 with a SD of 4.35 and mean BMI of low risk OSA cases was 25.42kg/m^2 with a SD of 3.74. The findings suggested that there is a significant association of increased BMI with high risk of OSA as p<0.05 (p=0.0001). Similar study by Viswanathan V et al revealed that there is a significant association between BMI and risk of OSA as p<0.05 (p=0.002).[2] In contrast to my study findings, in a study by Bironneau V et al, there is no significant association between increased BMI and increased severity of OSA as p>0.05(p=0.14)[13]

In the present study, 40.7% of the subjects had SBP of 120-139 mm Hg and 35.7% of the subjects has DBP between 80-99 mm Hg. These findings showed that there was a significant association of increasing blood pressure values with high risk of OSA as p<0.05. Similar findings were found in a study by Viswanathan V et al (2017), where they found that 76.16% of the subjects were hypertensive among 275 diabetic individuals and had a positive association of increased BP with high risk of OSA.[2]

In the present study, mean HbA1c of high risk OSA cases was 7.87% and low risk cases was 7.10% and it showed statistically significant association of increased HbA1c value with high risk of OSA as p<0.05 (p=0.001). The study corrugates with a study by Pillai A et al where they found out significant association of increased severity of OSA with increased HbA1c levels (p<0.014).[15]In contrast to the present study, a study by Kurosawa et al found out that there was no significant association between the severity of OSA and HbA1c level in diabetic subjects which may be due to intake of anti-diabetic drugs.[16]

9. Nursing Implications

Nursing education

Nursing curriculum should include chapters on evidenced based practice to identify symptoms of risk of OSA so that they are able to develop skills in identifying high risk group in medical and surgical wards and community settings.

Nursing practice

Mandatory screening and clinical assessment of all diabetic patients should be done periodically.

Nursing administration

Nurse administrator should make strict institutional policies to screen every diabetic patient for risk of OSA.

Nursing research

Researches can be done to find out risk of OSA in presence of other comorbidities like obesity, hypertension etc.

10. Recommendations

A similar study on the larger scale may help to draw more definite conclusions and generalizations. Collaboration with the sleep medicine department for confirmatory diagnosis of OSA through polysomnography after being screened as high risk OSA with the help of screening questionnaires like Berlin questionnaire. Once OSA is screened or diagnosed, health care professionals can help them to undertake behavioral modifications like weight loss therapies, dietary modification, exercises etc. Patients with diabetes should be followed up and care givers to be educated to identify signs of OSA and prevent complications.

11. Conclusion

The present study done to assess the prevalence of risk of Obstructive Sleep Apnea and its association with selected demographic variables and biophysical parameters among the patients with Type 2 Diabetes Mellitus attending OPDs of a tertiary care hospital was descriptive in nature. The study revealed moderate prevalence of risk of Obstructive Sleep Apnea (59%) among Type 2 Diabetes Mellitus patients. It provided the researcher with deeper insight regarding prevalence of Obstructive Sleep Apnea and its association with selected demographic variables and biophysical parameters. Based on the findings of the study it was recommended that similar study can be conducted in collaboration with sleep medicine department for confirmatory diagnosis of high risk OSA cases and provide appropriate treatment to the diagnosed patients. Expert opinions, direction of the guide and cooperation from the care givers made the study interesting and fruitful.

References

[1] Jehan S et al. Obesity, obstructive sleep apnea and type 2 diabetes mellitus: Epidemiology and pathophysiologic insights. International Journal of Sleep Medicine and Disorders 2018;2(3):52-8
[2] Viswanathan V et al. High Prevalence of Obstructive Sleep Apnea among People with Type 2 Diabetes Mellitus in a Tertiary Care Center. J of the Asso of Phy of India 2017;65:38-42
[3] Boyer S, Kapur V. Obstructive Sleep Apnea: Its Relevance in the Care of Diabetic Patients. Clinical Diabetes 2002;20(3):126-32
[4] Diabetes Mellitus. World Health Organisation. Available from: https://www.who.int/mediacentre/factsheets/fs138/en
[5] Sleepreviewmag.com/2018/05/nearly-1-billion-people-worldwide-sleep-apnea-international-sleep-experts
[6] Pamidi S and Tasali E. Obstructive Sleep Apnea and Type 2 Diabetes Mellitus: Is there a link? Frontiers in Neurology. 2012;l3(126):1-13
[7] Joshi JM et al. Obstructive sleep apnea and its prevalence in India. Respiratory mirror 2015;5(1):1-15
[8] Johnson S. Screening for Obstructive Sleep Apnea is Imperative for Diabetes Mellitus Patients. Curre Res Diabetes &Obes J. 2018;5(5):1-2
[9] Rache k et al. Obstructive sleep apnea and type 2 diabetes. Eur J Med Res 2010; 15(2): 152-6
[10] Wilding J. Diabetes and obstructive sleep apnea syndrome: Double trouble. Sleep Apnea 2018:1-4
[11] Algeffari M, Alkhamis A, Almesned A, Alghammas N, Albulayhi S, AlGoblan A. Obstructive Sleep Apnea Among People with Type 2 Diabetes in Saudi Arabia: A Cross-Sectional Study. Majmaah Journal of Health Sciences. 2018;6(2):32-9
[12] Edmonds PJ et al. Neck Grasp Predicts Obstructive Sleep Apnea in Type 2 Diabetes Mellitus. Sleep Disorders 2019:1-6
[13] Malik J A, Masoodi S A, Shoib S. Obstructive sleep apnea in Type 2 diabetes and impact of continuous positive airway pressure therapy on glycemic control. Indian J of Endo and Metabolism. 2017; 21(1):106–12.
[14] Bironneau V et al. Association between obstructive sleep apnea severity and endothelial dysfunction in patients with type 2 diabetes. Cardiovascular Diabetology 2017; 16(39):1-10
[15] Bhimwal RK, Makwana M, Jangid R, Bhati RL. To study the prevalence of obstructive sleep apnea in type 2 diabetes patients in Western Rajasthan, India. Int J Adv Med. 2017;4(4):894-902
[16] Pillai M et al. Effects of Sleep Apnea Severity on Glycemic Control in Patients with Type 2 Diabetes Prior to Continuous Positive Airway Pressure Treatment. Diabetes technology & therapeutics 2011;13(9): 945-9
[17] Kurosawa H et al. Association between severity of obstructive sleep apnea and glycated hemoglobin level in Japanese individuals with and without diabetes. Endocrine journal 2018; 65 (1): 121-7