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STUDY OF PREVALENCE OF UNDIAGNOSED OBSTRUCTIVE SLEEP APNEA (OSA) IN OBESE AND TYPE 2 DIABETIC INDIVIDUALS

Medicine

KEYWORDS: OSA,Obesity,Type 2 Diabetes Mellitus,Polysmnography,ESS

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ABSTRACT

Background: The prevalence of Type 2 Diabetes Mellitus(T2DM) and Obesity has reached epidemic proportions. Along with these diseases, Obstructive Sleep Apnea(OSA) also has emerged as a major cause for cardiovascular comorbidities. OSA despite being an increasingly recognized entity in the western world, is still not a commonly made diagnosis in India . There is a strong association of OSA with severity of Obesity and T2DM, both as a risk factor and complication. This study aims to reinforce this association.Aim: To study the prevalence of OSA in Obese and Type 2 Diabetes Mellitus individuals.Methods: Cross sectional hospital based study done on 35 obese patients with T2DM, who were screened for OSA by clinical history, relevant physical examinations and Epworth Sleepiness Scale (ESS).Limited Polysomnography(PSG) was performed on all patients. Apnea Hypopnea Index (AHI) ≥5 was considered to have OSA.Results: Of the 35 individuals in study group, 22 (63%) had AHI ≥5. 20%, 14% & 29% of study group had Mild, Moderate and Severe OSA respectively. Age predominance was in 4th & 5th decade.Symptoms like Snoring, Excessive Daytime Sleepiness (EDS) were the most common symptoms, and had statistically significant association with OSA($p<0.05$). Neck circumference and BMI were found to be significantly higher in OSA group compared with Non OSA group ($p<0.05$).Also, severity of OSA increased with increasing grades of obesity. Prevalence and severity of OSA was higher in Uncontrolled Diabetics than in Controlled diabetics. Furthermore, HbA1c values had moderate positive correlation (R=0.56) with AHI values. Conclusion: The high prevalence of OSA in obese patients with type 2 diabetes represents a serious public health problem and raises the possibility that some of the morbidity and mortality associated with obesity and type 2 diabetes may be attributable to undiagnosed OSA. Early detection and treatment of OSA in obese diabetic patients can prevent development of complications in them due to the combined effects of both diseases. Thus the need for screening obese type 2 diabetes patients for undiagnosed OSA has been reinforced by this study.

INTRODUCTION:

The prevalence of Type 2 Diabetes Mellitus (T2DM) and Obesity has reached epidemic proportions. The growing epidemic in the last decade has drawn the attention on Obstructive Sleep Apnea (OSA) as a cardiovascular risk factor. OSA is a frequent pathology and despite being an increasingly recognized entity in the western world, it is still not a commonly made diagnosis in India, particularly owing to lack of awareness even among health care professionals. It is characterized by reduction or complete cessation of airflow during sleep. These episodes of respiratory disturbance may be associated with decreases in oxygen saturation and arousal from sleep. There is a strong association of OSA with severity of obesity and T2DM, both as a risk factor and complication. Approximately 70% of patients with OSA are obese[1].Obesity related fat deposits may alter compliance of upper airway walls and narrow the luminal area, thus increasing the likelihood of airway collapse. The prevalence of OSA in type 2 diabetes has been found to range from 23% [2] to as high as 86% in the Sleep AHEAD study cohort [3], possibly due to the presence of shared risk factors such as obesity, visceral adiposity and advancing age. Glucose intolerance and insulin resistance associated with sleep-disordered breathing may be intermediate in the putative causal pathway to increased cardiovascular morbidity and mortality.

A clear understanding of the interrelationships between OSA, obesity, and T2DM may provide information that would allow effective strategies for prevention and/or intervention of these diseases.

AIMS AND OBJECTIVES

To study the prevalence of Undiagnosed Obstructive Sleep Apnea in patients with Obesity and T2DM.

SUBJECTS AND METHODS:

Cross sectional observational study done on 35 Obese Patients with Type 2 Diabetes attending ASRAM-GH Pulmonary medicine OPD, with or without complaints of Snoring and associated symptoms of OSA, as well as patients referred from other departments for evaluation of sleep disordered breathing, during the period of 1 year from December 2014 to December 2015.

Patients aged 40 to 70 years with Body Mass Index(BMI) >27.5 kg/m2 with Previously diagnosed or self-reported or newly diagnosed Type 2 Diabetes were included in the study.

Critically ill, mentally ill, uncooperative patients or patients with type 1 diabetes or patients with central sleep apnea were excluded.

History and clinical examination of patients were recorded as per a proforma, and their Epworth Sleepiness Scores (ESS) was calculated. Based on ESS, two groups were identified- those with excessive daytime sleepiness (ESS ≥ 10), no excessive daytime sleepiness (ESS <10). Based on BMI, subjects were divided into three groups as per the WHO classification.

Neck Circumference (NC) was measured and NC >40 cms was considered significant. Waist Circumference (WC) was measured and WC >102 cm in males and >88cms in females was considered significant for obesity.

The presence of co-morbidities mainly diabetes mellitus and the treatment history were recorded. All the diabetic patients were categorised based on HbA1C levels into controlled Diabetics (HbA1C ≤7) and Uncontrolled Diabetics (HbA1C >7).

All the patients in the study group were subjected to a whole night Limited 10 channel Polysomnography (Embletta MPR PG) with ECG, pressure transducers for nasal airflow, thoracic and abdominal impedance belts for respiratory efforts, pulse oximeter for oxyhemoglobin level, snoring sensor, and sensors for leg and sleep position and activity

The limited PSG data was analysed and a diagnosis of OSA was made

if the Apnea-Hypopnea index (AHI) was >5 events per hour with continued respiratory efforts and symptoms. Further, OSA was graded as mild, moderate or severe by AHI 5-15 events/hr, AHI 15-30 events/hr and AHI>30 events/hr respectively.

Data analysed.Quantitative data is presented with the help of Mean and Standard deviation (SD), comparison among study group is done with Pearson Correlation coefficient (R). Qualitative data is presented with the help of Frequency and Percentage table, association among study group is assessed with the help of Chi-Square test. P value < 0.05 is taken as significant level.

RESULTS:

A total of 35 obese and diabetic patients were included in this study, out of which there were 18 (51.4%) male and 17 (48.6%) female patients. Majority of the patients in this study group were middle aged with a mean age of 49.9 years(50.6 yrs. in males vs 49.2 yrs. in females).The mean BMI was 36.0 kg/m2, mean neck circumference was 41 cms, and the mean waist circumference was 104 cms.

22 (63%) patients had OSA, of these 7(20%), 5(14%) and 10(29%) subjects, had mild, moderate and severe OSA respectively. The mean AHI was 21.0 in males and 13.6 in females.

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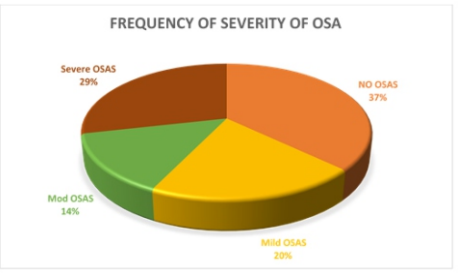

13 (59%) of the OSA patients were Males and 9 (41%) were Females. Males had more occurrence of severe disease (60%) than Females (40%).Most of the OSA patients were in the 40-49 years age group (50%). Mean age of OSA patients was 50.5 years and that of Non OSA patients was 49 yrs. There was no association between age and occurrence of OSA.

Our study group had 27 patients with symptoms of snoring, of which 18(66.66%) had OSA.Conversely, Majority of OSA patients were snorers (81.8%).However there was no statistically significant association (p value >0.05) between OSA and Snoring in our study.

Mean ESS score in OSA patients was higher than in Non-OSA

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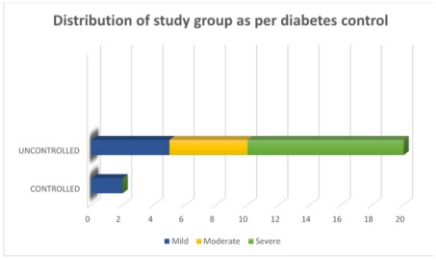
patients (12.54 vs 8.84).There was a significant association(p value <0.05) between significant ESS score (>10) and occurrence of OSA. The prevalence of EDS in patients with OSA was 81.8% versus those without EDS being 18.20%.There was **moderate positive correlation**(R=0.723) between ESS scores and AHI severity values.

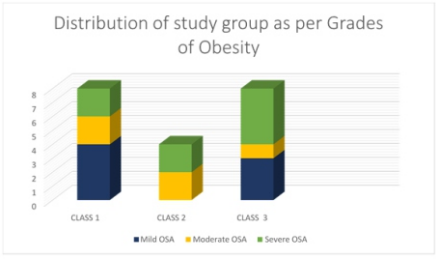
Our study found a statistically significant association (p value<0.05) between obesity and occurence of OSA.The mean BMI in patients with OSA was higher than those without OSA (37.2 vs 34.54) .There was also increased prevalence of Severe OSA in Class 3 obesity (60%).There was a **positive but weak correlation** (R =0.264) between Waist Circumference and AHI scores.

The mean NC in OSA patients was higher than in non-OSA patients(16.9 vs 15.38).The prevalence of OSA in individuals with significant neck circumference was slightly higher than the other group(77% vs 54.5%).However ,there was no statistically significant association (p value >0.05)between the two.

The prevalence of OSA in diabetics is 63%.Morever, there is a increased prevalence of OSA in Uncontrolled diabetics (71.4%).Uncontrolled Diabetics have higher incidence of Severe OSA (50%). The mean RBS (219.3 vs 178.9) and mean HbA1C values (9.91 vs 8.1) in OSA patients compared to non-OSA group.

There was **moderate positive correlation** (R=0.561) between HbA1C values and AHI scores, which means there is a tendency for high HbA1C scores go with high AHI scores (and vice versa).





DISCUSSION:

Our study has demonstrated a high prevalence (63%) of OSA in the study group which was in concurrence with the statistics reported in the literature on Type 2 Diabetes Mellitus and obesity, but it was higher than the prevalence of OSA in the general population, which has been reported to be between 16 and 27%.

The prevalence of mild, moderate and severe disease was 32%, 22% and 46%, respectively. The higher prevalence of severe disease in this study was arguably due to the hospital based model of the study and the fact that patients tend to present only when the disease is severe.
Male gender was associated with an increased prevalence and severity of OSA, and the most commonly proposed hypothesis for the same, include differences in the effect of weight, differences in body fat distribution, abnormalities in upper airway mechanics, control of breathing, and structural differences in upper airway dimensions. In a study conducted by Sharma and colleagues4, male gender was associated with a 10-fold higher risk of having OSA.

50% of OSA patients were in the age group of 40-49 years, 36% and 14 % were in the age group of 50-59 years and 60-69 years respectively, contrary to study done by Bixler et al[5], which showed that incidence of OSA increases with age. This variation could be due to patient demographics selected in our study which had more of 4th decade individuals.

Snoring was commonest symptom of OSA followed by EDS and witnessed apneas. Frequency of OSA among snorers was 66.6% and that among patients with EDS was 78.2%. Snoring is probably the most common complaint precipitating a referral to a sleep clinic.

ESS scores were significantly higher in patients with OSA.[6] In our study, 18 of 35 patients with ESS scores >10, were proven to have OSA. Thus, the usefulness of ESS as a screening tool for OSA with good specificity has been reiterated in our study. Therefore, symptoms, a high index of clinical suspicion and associated risk factors of OSA, along with an ESS score of >10 should guide further workup.

There was a statistically significant relationship between OSA and Obesity, with prevalence in the obese study group being 63%. The prevalence rates increased with increase in grades of obesity. The prevalence of OSA in obese populations is clearly elevated compared to the general population[7], which is not surprising given the close association of obesity with OSA.[6,7,8]

The mean neck circumference in OSA patients (16.9in) in our study was higher than that of the non OSA group (15.3in) but however, there was no statistically significant association (p value=0.18) between significant neck circumference and presence of OSA regardless of gender. According to various studies, increased neck circumference correlates with an increased risk as it tends to make the retropharyngeal space shallow.[9] 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[10].

Several studies have suggested that the metabolic syndrome is associated with OSA.[11,12] Although our study did not assess metabolic syndrome per se, we demonstrated a significantly higher prevalence of OSA in obese and Type 2 DM patients, both of which are components of metabolic syndrome.

31.8% patients had mild OSA, 22.7% patients had moderate OSA and 45.5% patients had severe OSA in 22 Type 2 Diabetic patients with OSA. The prevalence of severe OSA was higher in diabetic population especially in uncontrolled diabetics. The association of diabetes mellitus control with grades of severity of OSAS was statistically significant (p<0.05).

Several population-based studies from various geographical regions and involving a variety of ethnic groups have reported an independent association between self-reported snoring[13,14] or various measures of severity of OSA quantified by polysomnography (AHI or oxygen saturation) to altered glucose metabolism, insulin resistance, metabolic syndrome, and type 2 diabetes.[15] Aronsohn et al reported an OSA prevalence of 77% among 60 DM individuals.[16] However, the Sleep Heart Health Study (SHHS) found that only 58% of DM patients had OSA.[17] Our study included 'undiagnosed' DM individuals with HbA1c results of >6.5% as well as known DM in the analysis and this is likely to represent a better OSA prevalence rate amongst DM whilst the SHHS study had only recorded self-reported DM patients.[18] Our study could not determine the mechanisms responsible for this situation. Obstructive sleep apnea is caused by pharyngeal occlusion due to alterations in upper airway mechanical properties and/or disturbances in neuromuscular control.[19] The presence of pharyngeal neuropathy may cause the development of OSA in patients with type 1 DM.

Previous studies on diabetic patients showed that autonomic neuropathy is associated with a relatively high frequency of OSA.[20] The underlying mechanism remains unknown but could be

related to an impairment of the upper airway reflexes, possibly due to alterations of the autonomic nervous fibers involved in their regulation.[20]

There are only a few published studies that have examined the association between the severity of OSA and the HbA1c levels. Mean HbA1C in OSA patients was found to be higher than in non OSA patients (9.91 vs 8.1) however, these differences were not statistically significant. Our sample size may have been insufficient to detect a small but perhaps meaningful difference in glycosylated hemoglobin levels. Moreover, there was positive correlation (R=0.561) between HbA1C levels and AHI scores. Compared with patients without OSA, the adjusted mean HbA1C was increased by 0.9% in patients with OSA.

Our study was not designed to examine the mechanisms linking OSA and glucose control in T2DM. Although it remains possible that hyperglycemia may promote sleep disturbances, the current evidence supports the hypothesis that OSA, and its inherent characteristics, such as intermittent hypoxia, elevated sympathetic nervous activity [21,22] sleep fragmentation and low amounts of slow wave sleep[25], and cumulative sleep loss [23,24] has adverse effects on glucose tolerance.

LIMITATIONS OF OUR STUDY:

Our study was limited by a relatively small number of patients and included only south Indian population, and as such the findings could not be generalized to other populations. Since we have studied only the prevalence of various complications associated with OSA, we have not taken any controls.

CONCLUSION AND RECOMMENDATIONS:

The present study reveals that the majority of patients with T2DM and obesity have undiagnosed OSA, and thus Screening of all these patients for OSA is recommended. Since control of diabetes and severity of obesity had strong statistical association with grades of severity of OSA, therefore regular monitoring and control of risk factors is recommended along with the need for more intensive pharmacotherapy and weight reduction. Conversely, treating OSA may have clinically significant beneficial effects on glucose control and reduce the number of drugs needed and/or their dose regimen. Also, as OSA is one of the primary cause for cardiovascular abnormalities, regular monitoring of risk factors along with treatment is also recommended.

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