

A Prospective Cohort study of association between Oxygen Desaturation Index and severity of Obstructive Sleep Apnea

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ABSTRACT

Background: A full polysomnogram remains the gold standard investigation in the diagnosis of obstructive sleep apnea (OSA), as it provides a comprehensive data on sleep efficiency, sleep stages, Apnea Hypopnea Index (AHI) and over-night oximetry. Practical difficulties like need for a trained technician, complexity of test, availability of sleep labs and cost factor hinders the use of this test as a first line in diagnosing OSA. The aim of this study is to qualify the link between Oxygen Desaturation Index (ODI) measured using a stand-alone portable over-night oximetry device, which are considerably in-expensive and simple against AHI measured using a full polysomnogram in screening patients who attend sleep service.

Materials and methods: 60 patients of both sex attending OPD in tertiary care hospital with a diagnosis of OSA on a full polysomnogram were enrolled. Data including Body mass index (BMI), AHI and ODI were compared. Severity of OSA was graded using both ODI and AHI and the accuracy of ODI predicting AHI calculated.

Results: Majority of patients had milder forms of OSA measured by AHI (45%) and ODI (55.66%). There was a linear significant correlation between AHI and ODI grades with a p value of less than 0.01. A similar positive correlation was also found with BMI severity and ODI/AHI values.

Conclusion: ODI measured by nocturnal pulse oximetry compared to AHI is a cost effective surrogate tool for use as first-line screening test in OSA diagnosis. This would not only enable us perform tests on more number of OSA suspects but also accelerate the time to treatment and monitor the responses to therapy when indicated. ODI can be an easy alternative sleep study, testing patients posted for DISE (Drug Induced Sleep Endoscopy) and also to follow them up post-operatively in candidates who would benefit out of surgery.

Keywords: ODI, OSA, AHI, BMI, DISE

INTRODUCTION

Obstructive sleep apnea (OSA) is a constituent disease of sleep disordered breathing (SDB). OSA is characterized by recurrent upper airway obstruction causing apnea or hypopnea during sleep, which when

untreated can cause several complications such as cardiorespiratory, cardiovascular and autoimmune diseases. (1). Even though Polysomnography (PSG) remains the gold standard for OSA diagnosis,

practically many patients remain undiagnosed due to its feasibility and cost factor.

Apnea Hypopnea Index (AHI), though is emphasized more towards finding OSA severity, it does not take into consideration the duration and depth of hypopnea.(2) In order to curtail this issue, Oxygen Desaturation Index (ODI) is accounted in our study for its association in diagnosing severity of OSA. ODI is the number of desaturations (blood oxygen level drop below baseline) per hour during sleep. It can be measured by overnight oximetry which is an easy and cost-effective method compared to full PSG.

MATERIAL AND METHODS:

In our study we included 60 OSA patients (36 male and 24 females) presenting to ENT and Pulmonology OPD of Tagore Medical College, Chennai from August 2018 till January 2020 with sleep study reports (Resmed Apnea link Air Home sleep test). All these patients had mild to severe degrees of OSA. We subjected all of them to overnight oximetry after consent, as inpatients in our wards and correlated the effectiveness of ODI in the estimation on severity of OSA. 3% ODI was clinically significant in diagnosing OSA severity than 2% and 4% ODI as per previous credible studies (3,4). So hourly, 3% desaturation below baseline was taken into consideration for ODI. Patients with upper airway resistance syndrome, chronic obstructive pulmonary disease (COPD) and patients who could not sleep at least 4hrs in PSG were excluded from the study.

The following AHI was used to grade OSA as; mild sleep apnea (5 to <15 AHI), moderate sleep apnea (15 to <30 AHI) and severe OSA (>30 AHI)

accordingly.(5). The BMI (Body Mass Index) of the study population was also studied for correlation. BMI below 25 were grouped under as optimal, 25-30 as overweight and above 30 as obese category. ODI was also graded similarly as mild (5 to <15), moderate (15 to <30) and severe (>30) accordingly.

Pearson correlation was statistically analyzed using SPSS 22 software.

RESULTS:

Demographic details of the study group are as follows:

Age group varied from 22- 72 years, with 60% of study population being males and rest 40% being females. Body mass index ranged from 29 ± 11 . Average total sleep time was 342 minutes.

Among the study group, majority of people (45%) fell under the mild range of AHI and as well as mild range of ODI (51.66%) with only 23.3% in severe AHI grade and 18.3% in severe ODI grade. Only 25% of the study population fell in the obese and morbidly obese category as against 43.3% which were below overweight category, which was termed optimal BMI. (Table:1)

AHI and ODI was correlated by Pearson's correlation coefficient. Similarly ODI was correlated with BMI subcategories by Pearson's correlation coefficient. **Table 2** denotes strong positive correlation between ODI and AHI (R value 0.9839, P value 0.002446 at level of significance $p < .01$). It also shows similar strong positive correlation between ODI and BMI (R value 0.9724, P value 0.005481 at level of significance $p < .01$).

Severity	Number	Percentage
AHI		
mild	27	45
Moderate	19	31.6
Severe	14	23.3
ODI		
Mild	31	51.66
Moderate	18	30

Severe	11	18.3
BMI		
Optimal (<25)	26	43.3
Overweight(25-30)	19	31.6
Obese(>30)	15	25

Table: 1 –AHI, ODI and BMI descriptive data

	AHI	BMI
ODI	R value 0.9839 P value 0.002446 Level of significance at $p < .01$	R value 0.9724 P value 0.005481 Level of significance at $p < .01$

Table: 2 - Pearson's correlation ODI vs AHI and ODI vs BMI**DISCUSSION:**

Obstructive sleep apnea is a very common condition nowadays which is mostly underdiagnosed. It leads to life threatening day-time sleepiness as it affects the nocturnal sleep cycle due to apnea and hypopnea. The hypopnea is an easily measurable indicator with simple oximetry. (6). Though the gold standard for diagnosis of OSA is polysomnography, the search of a reliable, easier and non-invasive test has shown ODI as a much reliable and simpler alternative. We must also bear in mind ODI helps in grading of OSA as it has close association with AHI and BMI.

Since ODI at 3% is reliable, this indicator is taken into account in our study and attempted to find correlation with AHI and BMI categories. There is significant correlation between ODI and AHI as well as ODI and BMI identified in our study similar to that of Peppard et al (7). Hence this could be used as a fast screening test for grading OSA on a mass scale, with the help of simple non-invasive oximetry technique. Previous studies have accounted for similar correlation between ODI and sleep apnea grades, however they used the ODI data from polysomnography as variables as against in our studies where it was done separately in ward settings. (8,9). This has given better compliance for patients to sleep without much disturbing polysomnography measuring equipments belted to patients.

Overall this easy ODI indicator can help in deciding which patients may require continuous positive

airway pressure treatment (CPAP) or surgery for OSA after finding level of obstruction with investigations like Drug Induced Sleep Endoscopy. Netzer et al have documented that people with ODI >15 should undergo CPAP titration at home.(10).

Major limitation of our study is the selection of positive OSA patients into study group and subjecting them to overnight oximetry, which may have affected the strong positive correlation of sleep apnea syndromes and oximetry and also a smaller sample and limited demographic picture of 60 patients could be a limitation to suggest the results on a larger and more wider population practically.

CONCLUSION:

ODI has been studied to have strong positive correlation with AHI grades and BMI categories in line with previous literature. Though it does not offer a full picture of cause and severity of OSA as in by other investigations such as by full PSG and DISE, it does provide an easier way to screen patients of OSA using a more economical, non-invasive and simpler way of overnight oximetry for patients, who could be subjected for further evaluation and treatment of OSA.

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