Section: Respiratory Medicine

Original Research Article

ASSESSING THE DIAGNOSTIC VALIDITY OF THE OXYGEN DESATURATION INDEX IN OBSTRUCTIVE SLEEP APNEA

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ABSTRACT

Background: Obstructive Sleep Apnoea (OSA) is a common and underdiagnosed sleep disorder resulting in intermittent hypoxia and disrupted sleep architecture. It is associated with increased risks of cardiovascular, metabolic, and neurocognitive disorders. Polysomnography (PSG), which measures the Apnoea-Hypopnoea Index (AHI), is the diagnostic gold standard. The Oxygen Desaturation Index (ODI), defined as the number of oxygen desaturation events (≥3% in SpO_2) per hour of sleep, has emerged as a simpler, non-invasive alternative for assessing OSA. Establishing ODI as a reliable tool could enhance early detection and expand access to OSA diagnosis and treatment in resource limited settings.

Materials and Methods: This cross-sectional study was conducted in a tertiary care hospital included a total of 45 adult patients suspected of having OSA using the STOP-BANG questionnaire (scores ≥3). Overnight Level III PSG was done to measure AHI and ODI. Pearson's correlation coefficient was used to assess the relationship between AHI and ODI scores. Cronbach's alpha was calculated to assess reliability and internal consistency. Data was analysed using Statistical Package for the Social Science (SPSS) Version 20.

Results: Among 45 patients included in the study (male: 26, female: 19), mean age was 61.87 ± 10.66 years. Mean AHI and ODI values were closely aligned. A strong positive correlation was found between AHI and ODI ($r = 0.871$, 95% CI: 0.77–0.92, $p < 0.0001$), along with excellent reliability and internal consistency (Cronbach's alpha: 0.93).

Conclusion: Given strong correlation, simplicity and accessibility, ODI may serve as a valuable screening tool in primary care and resource-limited settings, potentially expanding early OSA detection and treatment.

Keywords: Obstructive Sleep Apnoea, Oxygen Desaturation Index, Apnoea-HypopnoeaIndex, Polysomnography

INTRODUCTION

Obstructive Sleep Apnea (OSA) is a sleep related breathing disorder marked by repeated upper airway obstruction during sleep which form the basis for symptoms like intrusive snoring, witnessed apneas, excessive daytime sleepiness(EDS).[1-3] It is linked to serious health issues such as cardiovascular disease,[4] and stroke.[5] It is also associated with reduced quality of life and greater utilization of healthcare resources.[6,7]

According to the American Academy of Sleep Medicine (AASM), OSA is defined as the presence of five or more predominantly obstructive respiratory events per hour of sleep in association with symptoms, or fifteen or more obstructive events per hour regardless of symptoms, as measured by polysomnography.[8]

The prevalence of obstructive sleep apnea (OSA) among Indian adults (defined as AHI ≥5) is approximately 11% overall, with 13% in men and 5% in women. Moderate-to-severe OSA affects around 5% of the population.[9]

Polysomnography (PSG) is considered to be the gold standard for diagnosis of OSA, estimation of its severity and measurement of treatment response.

The Oxygen Desaturation Index (ODI), defined as the number of oxygen desaturation events (≥3% drop in SpO_2), lasting for at least 10 seconds within an hour10, has emerged as a potential alternative or adjunct to PSG in diagnosing OSA, offers a simpler alternative using non-invasive pulse oximetry. Its clinical significance lies in its potential to screen for and stratify OSA severity, particularly in primary care and resource-limited settings. While convenient and widely available, ODI's diagnostic accuracy relative to PSG is still under investigation.[11]

This study assesses ODI in detecting OSA by evaluating its correlation with the Apnea-Hypopnea Index (AHI). Establishing ODI as a reliable tool could enhance early detection and expand access to OSA diagnosis and treatment.

Objectives

1. To measure the AHI and ODI using Level 3 PSG in patients suspected of OSA.
2. To evaluate the correlation between ODI and AHI.

MATERIALS AND METHODS

Study Design and Setting: This prospective, observational, cross-sectional study was conducted at the Department of Respiratory Medicine, Subbaiah Institute of Medical Sciences and Research Centre, over a period of 10 months from September 2024 to July 2025.

Source of Data: The study population consisted of patients attending the Respiratory Medicine Outpatient Department (OPD) during the study period.

Study Population and Sample Size: A total of 45 patients were included in the study. Patients were selected using a non-probability sampling method.

Eligibility Criteria

Inclusion Criteria

1. Patients aged 18 years and above.
2. Patients clinically suspected of having obstructive sleep apnoea (OSA) based on initial evaluation.

Exclusion Criteria:

1. Patients aged less than 18 years.
2. Hemodynamically unstable patients.
3. Patients with Respiratory failure requiring oxygen support or assisted ventilation.

Data Collection and Methodology

After obtaining written informed consent, eligible patients were enrolled in the study. Data were collected using a structured questionnaire that included demographic details, relevant medical history, and sleep-related symptoms.

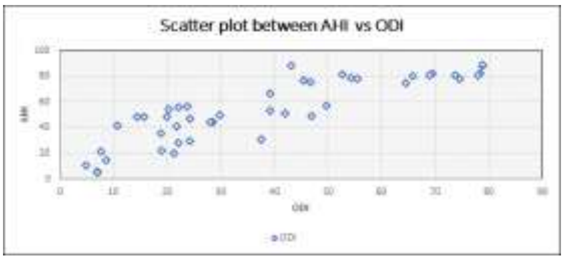
The STOP-BANG questionnaire was used as a screening tool to assess the risk of OSA. A STOP-BANG score of ≥3 was considered indicative of a high risk for OSA. Patients subsequently underwent overnight Level III polysomnography.

Key parameters recorded during the sleep study included the Apnoea–Hypopnoea Index (AHI) and the Oxygen Desaturation Index (ODI). Statistical analysis was performed to evaluate the relationship between AHI and ODI, and the findings were presented using appropriate tables and graphical representations.

Statistical analysis: All data was entered into Microsoft Excel and analysed using SPSS (Statistical Package for the Social Sciences) version 20 for Windows. Descriptive statistics—including percentages, diagrams and mean ± standard deviations will be used to summarize the data. Pearson's correlation coefficient was applied to evaluate the relationship between the Apnea-Hypopnea Index (AHI) and the Oxygen Desaturation Index (ODI). A p-value of <0.05 considered as statistically significant. Cronbach's alpha was calculated to assess reliability and internal consistency.

RESULTS

A Total of 45 patients (M:F – 26:19) were analysed. Participants ages varied from 42 to 91 years, with mean age of 61.87 ± 10.66 years. The mean BMI was 37.38 ± 7.17 kg/m². Hypertension was the major comorbidity. The mean value of AHI was 37.55 ± 23.65 events/hour, with variability ranging from 4.9 to 78.8 events per hour. The mean ODI was 52.92 ± 25.52 events/hour, with values ranging from 5.1 to 88.7 events per hour.



Pearson's correlation coefficient showed a strong positive correlation between AHI and ODI, with a coefficient(r)of 0.871(95% CI: 0.77 to 0.92) and a highly significant p-value of <0. 0001.This correlation demonstrates, that increase in AHI, indicative of more severe OSA, are closely associated with increase in ODI [Figure 1]. Cronbach's alpha was 0.93, indicating excellent reliability and internal consistency between AHI and ODI.

Table 1: Correlation between AHI vs ODI

Variable		ODI				Correlation coefficient	P-value
		Normal	5-15(%)	15-30(%)	More than 30(%)		
AHI	Less than 5	1(100)	0	0	0	0.871	0.0001
	5-15	0	4 (80)	1(20)	2 (5.7)		
	15-30	0	0	4(80)	11 (31.4)		
	More than 30	0	0	0	22 (62.9)		
Total		1(100)	4(100)	5(100)	35(100)		

Table 2: AGE VS AHI

Age		AHI				Total
		Less than 5	5-15	15-30	More than 30	
Age	41-50	0	1	0	5	6
	51-60	1	1	8	5	15
	61-70	0	4	5	9	18
	71-80	0	0	1	2	3
	81-90	0	1	1	0	2
	91-100	0	0	0	1	1
Total		1	7	15	22	45

Table 3: Age VS ODI

		ODI			Total
		5-15	15-30	More than 30	
Age	41-50	1	0	5	6
	51-60	1	1	13	15
	61-70	3	3	12	18
	71-80	0	1	2	3
	81-90	0	0	2	2
	91-100	0	0	1	1
Total		5	5	35	45

Table 4: Gender VS AHI

	AHI				Total
	Less than 5	5-15	15-30	More than 30	
Male	0	3	6	17	26
Female	1	4	9	5	19
Total	1	7	15	22	45

Table 5: Gender VS ODI

		ODI			Total
		5-15	15-30	More than 30	
Gender	Male	1	1	24	26
	Female	4	4	11	19
Total		5	5	35	45

Table 6: Correlation Between Parameters

		AGE	AHI	ODI	BMI
AGE	Pearson Correlation	1	-.295*	-.263	-.135
	Sig. (2-tailed)		.049	.081	.378
	N	45	45	45	45
AHI	Pearson Correlation	-.295*	1	.871**	.106
	Sig. (2-tailed)	.049		.000	.488
	N	45	45	45	45
ODI	Pearson Correlation	-.263	.871**	1	.197
	Sig. (2-tailed)	.081	.000		.195
	N	45	45	45	45
BMI	Pearson Correlation	-.135	.106	.197	1
	Sig. (2-tailed)	.378	.488	.195	
	N	45	45	45	45

Table 7: Reliability

Cronbach's Alpha	N of Items
.930	2

DISCUSSION

This study demonstrated a strong correlation between the AHI and ODI, with a correlation coefficient of $r = 0.871$ ($p < 0.001$), suggesting that ODI is a reliable indicator of OSA severity. Importantly, ODI offers a less invasive alternative to traditional measures like AHI, which typically require polysomnography.[12,13]

Varghese et al. (2022) investigated the potential of ODI as an alternative parameter for screening patients with severe OSA. Their study found a strong positive correlation between ODI and AHI, with a correlation coefficient of $r = 0.91$ ($p < 0.001$). This finding reinforces the validity of ODI as a reliable measure of OSA severity. The authors highlight that using ODI as a screening tool could help broaden access to OSA diagnosis, particularly in settings where PSG availability is limited or impractical.[11]

Similarly, Chen et al. (2021) assessed the diagnostic accuracy of ODI in patients with sleep-disordered breathing and metabolic comorbidities. The study reported high sensitivity and specificity of ODI for detecting moderate to severe OSA, concluding that ODI serves as an effective surrogate marker for AHI, especially in high-risk populations. This study highlighted the clinical relevance of oxygen desaturation as a key physiological consequence of obstructive events.[12]

The study by Thamilan et al.(2024) found a statistically significant correlation between ODI and AHI with a correlation coefficient of $r=0.94$($p<0.001$). This confirms that ODI can reflect OSA severity, supporting its use as a surrogate marker for AHI in sleep disorder assessment.[13]

A study conducted by Rosa JCF da et al. (2021) in an elderly population demonstrated that portable oximetry-derived ODI had a strong linear correlation with AHI ($r = 0.93$, $p < 0.05$). The study also showed high accuracy in differentiating between varying severities of OSA, regardless of sex, body mass index, or sleep position, highlighting the robustness and broad applicability of ODI across diverse patient groups.

Overall, the findings from this study reinforce the clinical relevance of ODI as a practical, reliable, and accessible tool for the assessment of OSA severity. While not a replacement for comprehensive sleep studies, ODI serves as a valuable adjunct in both clinical and community settings, enabling earlier identification and intervention for patients at risk of OSA.[14]

Limitations: The study's findings should be interpreted in light of certain limitations. The relatively small sample size and single-centre design may restrict the generalizability of the results. Although the Oxygen Desaturation Index is a practical screening tool, it does not provide detailed information on sleep architecture and arousal patterns available through full polysomnography.

CONCLUSION

The study confirmed a strong positive correlation between AHI and ODI, showing ODI as a less intrusive alternative for diagnosing OSA. Patients with higher AHI tend to have higher ODI, suggesting that as breathing disturbances increase during sleep, oxygen desaturation events also increase. This supports the clinical use of ODI as a surrogate or complementary measure for AHI in diagnosing and assessing sleep apnoea severity.

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