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STUDY TO VALIDATE FEASIBILITY OF OVERNIGHT PULSE OXIMETRY IN DIAGNOSIS OF OSA

KEYWORDS: OSA (Obstructive Sleep Apnea), PSG (Polysomnography), ODI (Oxygen desaturation Index), AHI (Apnea Hypopnea Index), OSAHS (Obstructive Sleep Apnea Hypopnea Syndrome)

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ABSTRACT

BACKGROUND: *Despite evidence that untreated OSA (obstructive sleep apnea) threatens public health, safety and productivity, current estimates reveal that majority of women and men with moderate to severe OSA remain undiagnosed. The gold standard for the diagnosis of OSA is overnight polysomnography (PSG). However this test has not been alluring for its cost and requirement of technical expertise. Many alternatives to PSG have been used for diagnosing OSA and specifically pulse oximetry, is under evaluation world over, because of its easy availability, lack of expertise required and economic factors. Objective of this study was to validate the feasibility of using overnight pulse oximetry in diagnosing OSA and then comparing its sensitivity with PSG in diagnosing OSA.*

MATERIAL AND METHODS: *The study was a prospective observational study carried out at the Department of Pulmonary Medicine of tertiary care hospital. Total of 30 patients with suspected OSA based on history, Epworth Sleepiness Scale (ESS) and Berlin questionnaires (BQ) were studied. The patients were subjected to overnight "pulse oximetry". The study included monitoring the apnea episodes and oxygen desaturation index (ODI) as defined by American Thoracic Society (ATS). These patients were then subjected to overnight PSG and the results were compared.*

Results: *Pulse oximetry revealed that, 3 had ODI less than 5/hour, 1 patient had ODI more than 5/hour and less than 10, 3 had ODI more than 10/hour and less than 15, and 23 had ODI more than 15/hour. When the results of oximetry were compared with PSG, it confirmed mild OSA in 4, moderate in 4, severe OSA in 19 and a normal study in 3.*

Conclusion: *Clinical evaluation and overnight pulse oximetry together can be used as an efficient tool for diagnosing patients of severe OSAHS prior to subjecting them to sophisticated overnight polysomnography.*

INTRODUCTION

PSG is time consuming, expensive and is not easily available. The study was conducted to evaluate the efficacy of clinical and pulse oximetry criteria in the form of sensitivity in diagnosis of obstructive sleep apnea as compared to PSG.

MATERIAL AND METHODS

Place of study

Department of Pulmonary Medicine of tertiary hospital, Pune.

Study design

Prospective observational study.

Study population

All patients with suspected OSA

Sample size:

A total of 30 patients

Sampling methods:

Simple random sampling based on history and Berlin questionnaires.

Inclusion criteria

Suspected cases of OSA based on Berlin questionnaires.

Exclusion criteria

1. The mimicker of OSA, who were ruled out clinically and with relevant tests.
2. Patients unwilling to participate.
3. Known case of OSA

Period of study:

Jun 2016 – Nov 2016

Methodology:

1. Selected patients were admitted to Department of Pulmonary Medicine.
2. The mimickers of OSA were ruled out clinically and with relevant tests.
3. Patients were examined clinically and asked to complete 'Berlin Questionnaire' proforma. They were then subjected to overnight "pulse oximetry".
4. Evaluation also included recording the apnea episodes and oxygen desaturation index (ODI) as defined by American Thoracic Society (ATS).
5. Patient were then subjected to overnight PSG.
6. PSG reports were compared with clinical and pulse oximetry and their sensitivity was compared.

Equipment:

1. Pulse oximeter
2. Polysomnography laboratory

Analysis:

Data analysis was done by using Statistical Package for Social Sciences (SPSS) version 17.0. Receivers operating characteristic curve was used to find the sensitivity of pulse oximetry with PSG.

RESULTS

Among the 30 patients included in the study, 24 were male's and 6 female's, youngest was 22 years and oldest was 73 years with the mean age of 47.9 (±13.26) years.

Mean Epworth sleepiness scale score was calculated to be 13.53 with standard deviation of 4.6. Minimum and maximum scores were 5 and 22 . As per Berlin Questionnaire, all presented with snoring, 25 (83.3%) presented with tiredness, 16 (53.3%) complained their spouse noticed breathing pauses during sleep, 12 (40%) complained of increase in weight, 12 (40%) were diagnosed with high blood pressure and were on antihypertensive medication and 9 (30%) complained of falling asleep while driving.

When all clinically suspected cases of OSA were subjected to pulse oximetry, 1 had ODI >5/hour, 3 had ODI >10/hour, 23 had ODI >15/hour and 3 had ODI <5/hour . The minimum value of oxygen desaturation index (ODI) was 3/hour and maximum value was 116/hour. Mean ODI was calculated to be 45.4/hour and standard deviation was 32.34/hour.

As per PSG, AHI score >5-14 events/hr is categorized as mild OSA, >15-29 events/hr as moderate OSA and >30 events/hr as severe OSA.

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Out of 30 patients, 27 were diagnosed with OSA by overnight polysomnography, 4 (13.3%) had mild OSA, 4 (13.3%) had moderate OSA, 19 (63.4%) had severe OSA and 3 (10%) were normal. The mean (±standard deviation) AHI was 50.03 (±30.7) events/hr.

Table 1: Frequency according to AHI in 27 patients, detected to have OSA as per PSG

AHI	Frequency	Percent (%)
>5-14 events/hr	4	14.8
>15-29 events.hr	4	14.8
>30events/hr	19	70.4
Total	27	100.0

Subset analysis on the basis of sex, showed that out of 24 male participants, 1 had ODI >5/hour, 2 had ≥10/hour, 18 had ODI >15/hour and 3 had ODI <5/hour by pulse oximetry. On comparison with PSG, 2 had mild OSA, 4 moderate OSA, 15 severe OSA and 3 normal PSG. Out of 6 females, 1 had ODI >10/hour and 5 had ODI >15/hour. On comparison with PSG report, 2 had mild OSA and 4 severe OSA.

Pulse oximetry analysis according on the age , showed ODI <5/hour in 2 (age 21-60 years), ODI >5/hour in 2 (age 21-40 years), ODI >10/hour in 3 (age 41-80 years) and ODI >15/hour in 23 (age 31-80 years). PSG detected normal in 3 (age 21-60 years), mild OSA in 4 (age 31-80 years), moderate OSA in 4 (age 31-70 years) and severe OSA in 19 (age 31-80 years).

By using correlation test p-value <0.05, there was strong positive correlation between AHI by PSG and ODI by pulse oximetry as depicted in the scatter plot diagram.

Fig1. Scatter plot showing strong correlation (correlation coefficient r = 0.843, p value < 0,001) between ODI by pulse oximetry and AHI by polysomnography.

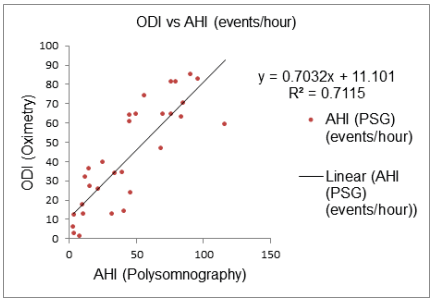
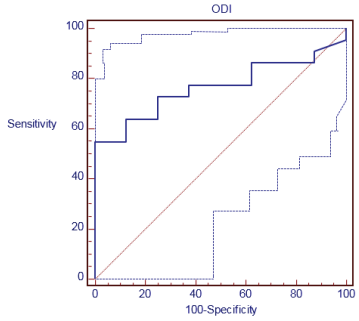


Fig 2. Receivers operating characteristic (ROC) curve for oximetry and PSG depicting 54.5% sensitivity with pulse oximetry.



Area under the ROC curve-0.764, Standard error-0.091, 95% Confidence interval-0.574 to 0.899,Significance level P (Area=0.5)-0.0036. The ROC curve for oximetry and polysomnography has demonstrated that sensitivity of oximetry is 54.5% in our study

DISCUSSION

The pulse oximetry as a tool to study overnight oxygen saturation trends has been well studied and validated. The high-quality, pulse oximeters deliver accurate values of SPO2 that differ from arterial blood gas probes by <0.5% (±1.8%).[1]

In our study, all 30 cases fulfilling minimum diagnostic criteria for OSA based on history and clinical examination were taken for overnight pulse oximetry, which revealed, 1 had ODI >5/hour, 3 had ODI >10/hour and 23 had ODI >15/hour. Out of these 30 patients, 27 were diagnosed with OSA by overnight polysomnography, 4 (13.3%) had mild OSA, 4 (13.3%) had moderate OSA, 19 (63.4%) had severe OSA and 3 (10%) were normal. There was strong correlation between ODI by pulse oximetry and AHI by PSG. The receivers operating characteristic (ROC) curve for oximetry and PSG showed sensitivity of clinical and pulse oximetry criteria for diagnosis of OSA as 54.5%.

Bennet and Kinnear, in their 1999 editorial, stated overnight pulse oximetry "sleep on the cheap" because it generates a lot of data at a very low cost[2] Epstein and Dorlac deducted initial diagnosis with home-based overnight pulse oximetry would save $4,290 per 100 patients versus diagnostic nocturnal polysomnography or split-night studies.[3] Chiner et al subsequently worked out how many nocturnal PSG's could be saved by overnight pulse oximetry in the initial diagnosis for patients with varying severity of OSA.[4] They showed that in 275 suspected cases, of which 216 patients were confirmed to have OSA, pulse oximetry could have saved 140 polysomnographic studies in the group with an oxygen desaturation index (ODI) >5events/hour, 119 in the group with an ODI >10/hour, and 105 in the group with an ODI >15/hour.[4]

There is no universally accepted definition of an oxygen desaturation in sleep-disordered breathing. In most publications, an oxygen desaturation is defined as a decrease of 4% from baseline SPO2.[5,6] Whereas one definition of an oxygen desaturation is in common use, no such uniform definition exists for a normal or abnormal oxygen desaturation index (ODI: oxygen desaturations per hour of sleep). There are generally three cut off points for an abnormal ODI that appear to mirror the definition of hypopneas per hour of sleep for that study. The threshold for an abnormal ODI is either >5 desaturations per hour 7 ,>10 desaturations per hour8, or >15 desaturations per hour.9

In our study desaturation event was considered when the haemoglobin saturation level (SPO2) fell below 4% from baseline saturation. Baseline saturation was considered as the mean saturation in the previous minute. Fall in oxygen saturation to >4% in the interval 90–100% of saturation were also considered as desaturations.

In 1991, Cooper et al studied a group of 41 patients with suspected sleep apnea and found that the sensitivity and specificity of pulse oximetry for identifying OSA was dependent on the AHI.[10] For patients with an AHI >25 events per hour, the sensitivity was 100% and the specificity 95%. For patients with AHI >15 events per hour, these values decreased to 75% and 86%; for patients with AHI >5 events per hour, to 60% and 80%, respectively. The authors concluded that pulse oximetry is an effective tool for screening patients with moderate to severe sleep apnea.[10]

CONCLUSION

This study was aimed to assess sensitivity of oximetry criteria for the diagnosis of OSA and compared it with gold standard PSG. There is a strong correlation between and oximetry criteria and PSG and as this correlation maintained its statistical significance, severe Obstructive Sleep Apnoea Hypopnea Syndromes can be diagnosed by combining clinical evaluation with pulse oximetry.

REFERENCES:

1. 1Farre R, Montserrat JM, Ballester E, et al. Importance of the pulse oximeter averaging time when measuring oxygen desaturation in sleep apnea. Sleep 1998; 21: 386–90
2. 2Bennett JA, Kinnear WJM. Sleep on the cheap: The role of overnight oximetry in the diagnosis of sleep apnoea hypopnoea syndrome. Thorax 1999; 54: 958–959.
3. 3Epstein LJ, Dorlac GR. Cost-effectiveness analysis of nocturnal oximetry as a method of screening for sleep apnea-hypopnea syndrome. Chest 1998; 113: 97–103

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4. 4Chiner E, Signes-Costa J, Arriero JM, et al. Nocturnal oximetry for the diagnosis of the sleep apnea-hypopnea syndrome: a method to reduce the number of polysomnographies? Thorax 1999; 54: 968–71.
5. 5Epstein LJ, Dorlac GR. Cost-effectiveness analysis of nocturnal oximetry as a method of screening for sleep apnea-hypopnea syndrome. Chest 1998; 113: 97–103
6. 6Rauscher H, Popp W, Zwick H. Computerized detection of respiratory events during sleep from rapid increases in oxyhemoglobin saturation. Lung 1991; 169: 335–42
7. 7Cooper BG, Veale D, Griffiths CJ, et al. Value of nocturnal oxygen saturation as a screening test for sleep apnea. Thorax 1991; 46: 586–88.
8. 8Williams AJ, Yu G, Santiago S, et al. Screening for sleep apnea using pulse oximetry and a clinical score. Chest 1991; 100: 631–35.
9. 9Vazquez JC, Tsai WH, Flemons WW, et al. Automated analysis of digital oximetry in the diagnosis of obstructive sleep apnea. Thorax 2000; 55: 302–7.
10. 10Cooper BG, Veale D, Griffiths CJ, et al. Value of nocturnal oxygen saturation as a screening test for sleep apnea. Thorax 1991; 46: 586–88.