Clinical Evaluation of Overnight Oximetry Monitoring of High Risk Patients for Obstructive Sleep Apnea

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ABSTRACT:

BACKGROUND:

Obstructive sleep apnea (OSA) is a condition of sleep related pharyngeal collapse, in which recurrent episodes of upper airway occlusion occur during sleep causing diminution (hypopnea) or cessation of airflow (apnea) in the pharynx provoking arousals and sleep fragmentation, resulting in daytime sleepiness.

Oximetry alone is very valuable tool in the diagnosis and management of OSA, it can identify most cases allowing referral for continuous positive airway pressure (CPAP) treatment.

OBJECTIVE:

To evaluate the overnight oximetry monitoring as a swift and accessible

PATIENTS AND METHOD:

Cross sectional study of 20 patients, 12 males and 8 females with high probability of OSA, attended to respiratory clinic in Baghdad teaching hospital suffering from excessive daytime sleepiness, they were clinically evaluated plus using overnight oximetry as an objective testing method.

RESULTS:

The study sample was 20 patients, 12 males (60%), 8 females (40%), mean age 48 years, mean BMI 45.6 Kg/m^2, female mean BMI 53.1 Kg/m^2, male mean BMI 37 Kg/m^2, and mean basal Po2 saturation 89.6 %.

Desaturation index (DI) show significant correlation with AHI, BMI, and gender, while no significant correlation with age. AHI show significant correlation with baseline SPO 2 and gender, and no correlation with BMI and age.

CONCLUSION:

Desaturation index assessed by nocturnal pulse oximetry maintain its utility as a screening method in the recognition of obstructive sleep apnea in obese patients with high clinical pretest suspicion. DI when combined with appropriate clinical evaluation could be used as an initial diagnostic test for OSA.

KEY WORDS: Obstructive sleep apnea, pulse oximetry.

INTRODUCTION:

Obstructive sleep apnea/hypopnea syndrome is defined as the coexistence of unexplained excessive daytime sleepiness with at least five obstructed breathing events (apnea or hypopnea) per hour of sleep. (1)

It is the third most common serious respiratory condition after asthma and COPD, in some respiratory unites it has now become the commonest reason for specialty referral. [2]

Obstructed sleep apnea (OSA) occur in around 2-4% of middle aged male more than in female because of fat distribution as upper body obesity and thus neck obesity is more a male pattern. [2, 3]

Predisposing factors

The predisposing factors to the sleep apnea/hypopnea syndrome include male gender, which doubles the risk; Smokers are three times more likely to have OSA, due to inflammation and fluid retention in the upper airway. Obesity, which is found in about 50%, because para pharyngeal fat deposits tend to narrow the pharynx. Nasal obstruction or a recessed mandible can further exacerbate the problem.

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Acromegaly and hypothyroidism also predispose by causing sub mucosal infiltration and narrowing of the upper airway. Sleep apnea is often familial, where the maxilla and mandible are backset, narrowing the upper airway.

Alcohol and sedatives predispose to snoring and apnea by relaxing the upper airway dilating muscles. [3]. Tonsillar hypertrophy, macroglossia, retrognathia/micrognathia, and upper airway mass lesions can contribute to upper airway narrowing. [4]

Clinical evaluation

- Determine who is at risk of OSA? [5]
- Carful history: dose patient snore? Does he or she has daytime sleepiness? hypertensive? morning headache, decrease concentration and memory.

  Excessive daytime sleepiness is the principal symptom, which can have assessed by Epworth sleepiness scale (figure 1). [3,6] Epworth Sleepiness Score >11 considered significant. [6] Snoring is virtually universal. Feels that he or she has been asleep all night but wakes unrefreshed. Impaired cognitive function and work performance, depression, irritability and nocturia are other features. (3)
- Physical examination: Focus on risk factors for OSA such as obesity (body mass index (MBI) >30 kg/m2), increased neck circumference, anatomical abnormalities reducing pharyngeal caliber (e.g. micrognathia, enlarged tonsils), and nasal obstruction (e.g. polyps, deviated septum). [7]

Cardiovascular complications associated with OSA include hypertension, myocardial infarction, stroke, cardiac arrhythmias, structural cardiac changes and cardiac failure. There is an association between OSA and the metabolic syndrome (visceral obesity, insulin resistance, hypertension, dyslipidemia). [7]

Although hypoxemia, hypercapnia and elevation of pulmonary artery pressure occur during apneas, cor pulmonale is unusual unless there is concomitant lung disease (e.g. COPD). [7]

Diagnosis

Polysomnography is the gold standard for diagnosis of obstructive sleep apnea. [4]

Although OSA may be diagnosed based on clinical features and a limited sleep study with overnight oximetry, definitive assessment requires polysomnography. [7]

OSA is usually diagnosed when there are more than 15 apneas or hypopneas per hour, each lasting 10 seconds: apnea/hypopnea index (AHI) >15. For OSA to be regarded as clinically significant, requiring treatment, the patient should have typical symptoms (e.g. daytime sleepiness) combined with an AHI>15.These are usually associated with oxygen desaturation of >4%. [7]

classification for sleep study modality is: [2]

1. Overnight oximetry alone.
2. Respiratory PSG: More than just oximetry with other channels such as snoring, body movement, heart rate, oronasal airflow, chest and abdominal movements, leg movements.
3. Full PSG.

Overnight oximetry alone is not sufficiently sensitive or specific in patients with moderate to high pretest probability of OSA; however, normal oximetry may be helpful in ruling out OSA and avoiding polysomnography in patients with a low pretest probability. [4] The sensitivity of oximetry for the diagnosis of OSA was 98% and the specificity was 46%. The positive and negative predictive values for diagnosing sleep apnea syndrome were 77% and 94%, respectively. [2]

Figure 1: Epworth Sleepiness Scale.

AIM OF STUDY:

Evaluation of overnight oximetry monitoring as a swift and accessible screening tool in patients whom complaints are compatible with OSA.

PATIENTS AND METHODS :

A cross sectional study which includes 20 patients (12male and 8 female), clinically suspected of having OSAHS who were attended the respiratory clinic in Baghdad teaching hospital for evaluation of possible OSA between January 2014 to October 2014. Detailed history, examination and investigations data collected at baseline, BMI was calculated. The Epworth sleeping scale also administrated as baseline.

Inclusion criteria: adults, overweight or obese, Epworth score above 11[6], and snoring. Exclusion criteria: patients < 18 years, normal BMI, patients with complex unstable medical conditions, such as severe congestive heart failure, severe COPD and ICU patients.

The study consisting of two parts: the first comparing desaturation index (DI) with age, gender, BMI, apnea/hypopnea index (AHI), the second one comparing AHI with the same parameters in the first part in addition to basal pulse oximetry (Spo2).

The portable monitor used to measure desaturation index (DI) & AHI (RS01 respiration sleep monitor CONTEC medical system co., Ltd. made in china, serial number *JJ1308200005*) records three simultaneous signals: respiratory (nasal) flow, heart rate and pulse oximetry (Spo2).

The AHI calculated via nasal cannula with mouth sensor. The corresponding automated algorithm considered that an apneic event had occurred when there was a > 80% reduction in airflow and that the hypopnea had occurred when there was a reduction in airflow of at least 50%, sum of both events divided on recording time give the AHI. [8] AHI considered normal if < 5, 5-14.9 mild, 15-29.9 moderate and > 30 as severe. [4] Respiratory events were scored when desaturations >4% occurred, the number of scored desaturations divided by the estimated sleep duration result in DI. OSA is dominant when SPO2 fall > 4% and, and desaturation index (DI) > 30 events/hour. [9]

All analyses carried out using SPSS; version 20 software. the statistical level of significance was set as P< 0.05.

RESULTS:

The study sample was 20 patients, 12 males (60%), 8 females (40%), mean age 48 years, mean BMI 45.6 Kg/m^2, female mean BMI 53.1 Kg/m^2, male mean BMI 37 Kg/m^2, and mean basal Po2 saturation 89.6 %.

Part I (comparing DI with AHI, BMI, gender, age):

DI with AHI: AHI was normal in 4 patients (20%), 1 patient with mild AHI (5%), 6 patients with moderate AHI (30%), and 9 patients with severe AHI (45%). 10 patients (50%) with DI> 30 events/hour, and 5 of them (50%) with severe AHI, figure 2. There is significant correlation (P value 0.01)

DI with BMI: 18 patients (90%) were obese, and all 10 patients with DI>30 events/hour are obese**,** figure3. There is significant correlation (**P value: 0.00**).

DI with Gender: For DI>30 events / hour, the male/ female ratio equal (5male and 5 females from 10 patients), while for DI<30 events / hour, from 10 patients there are 7male and 3female (70% male/ 30%female), figure4. There is significant correlation (P value 0.00).

DI with Age: There is no significant relation between DI and age, but in this study, we have 4 elderly patients =/> 60 years old, DI of 3 of them was >30 events / hour, figure 5. (P value 0.1)

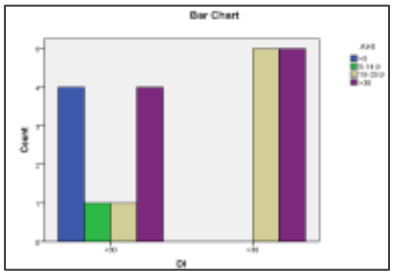

Figure 2: DI correlation with AHI.

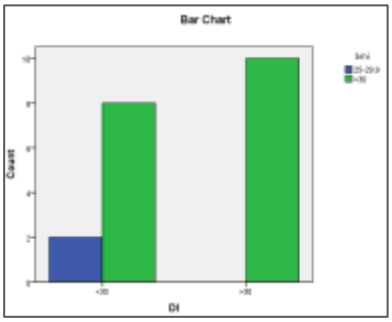

Figure 3: DI correlation to BMI.

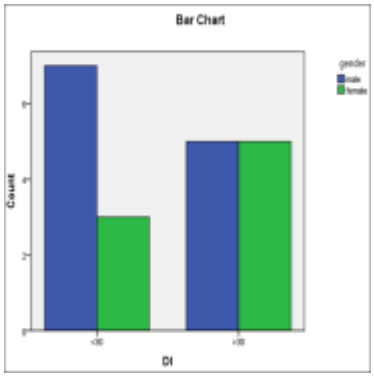

Figure 4: DI correlation to gender.

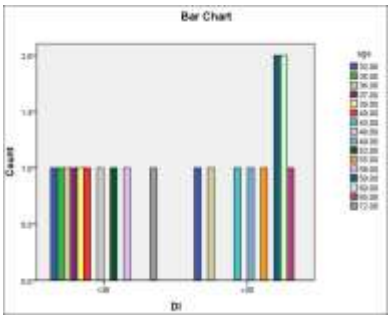

Figure 5: DI correlation to age

Part II (comparing AHI with age, gender, BMI and basal O2 saturation):

AHI with Age: AHI show no significance correlation with age, but we can see that all four elderly patients =/> 60 years old show severe AHI, figure 6. **(P value 0.1)**

AHI with Gender: of the 16 patients with mild, moderate to severe AHI, 9 patients (56%) was males, and 7 of them (44%) was females. From 9 patients with severe AHI, 7 patients (77.8%) was male and 2 patients (22.2%) was female, figure7. There is significant correlation (P value 0.00).

AHI with BMI: 14 of 18 obese patients (70%) show moderate to severe AHI, 1 patient (5%) show mild AHI, and three patients (15%) show normal AHI, figure 8**.** There is no significant correlation **(**P value 0.07).

AHI with Basal O2 Saturation: 8 patients (40%) with baseline SPO2 <90% revealed only one with normal AHI while others with moderate to severe AHI. 8 patients (40%) with baseline SPO2 90-94% revealed one of them with normal AHI. 4 patients (20%) with baseline SPO2 >94% revealed two with normal AHI, figure 9. There is significant correlation (P value 0.04).

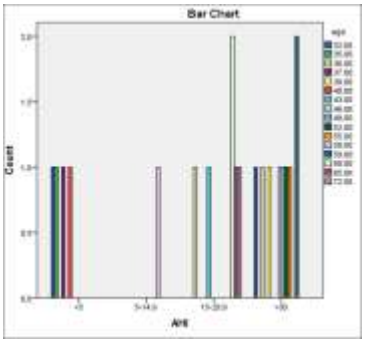

Figure 6: AHI correlation to Age

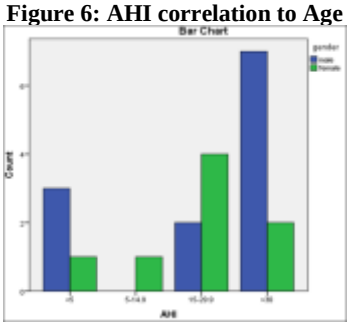

Figure 7: AHI correlation to gender.

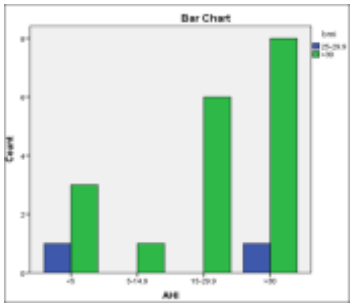

Figure 8: AHI correlation to BMI.

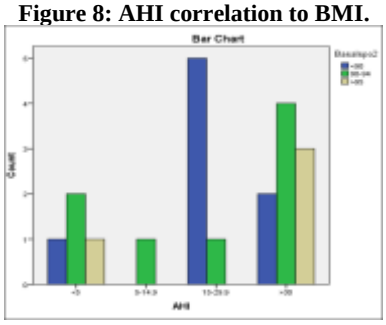

Figure 9: AHI correlation to basal PSO2.

DISCUSSIONS:

This study showed significant correlation between DI and AHI (50% of patients with DI>30 events / hour and 50% of them with severe AHI, P value 0.01). A study by Bouscoulet L et al exhibit high agreement between the desaturation index and both the apnea-hypopnea index and the respiratory disturbance index in adults with suspected obstructive sleep apnea syndrome in Mexico City. [8] Another study by Fietze I et al also showed a good correlation that was found between the AHI and the DI. [10] Also this result is in agreement with the Chung F. et al

study [11] and Arik B, et al study (AHI strongly correlated with oxygen desaturation index (r = 0.844, p < 0.001)). [12]

In this study no significant correlation was established between AHI and age (P value = 0.1). However, all elderly patients =/> 60 years old in this study show tendency for higher AHI. Also same results were obtained when we compare DI with age as there was no significant correlation but the elderly people also show tendency for high DI > 30 events / hour. A study by Oztura I. et al showed no significant correlation between AHI and age, and Higher AHI value with increasing age were seen only in women but not in men. [13] Another study by Philip P. et al mentioned that for DI and increasing age, a significant correlation was found in women (linear tendency test: P=0.02) but not in men. [14]

In this study female were morbidly obese, female mean BMI was 53.1, while males mean BMI was 37. AHI show no significance correlation with BMI (P value = 0.7), however obese females show high tendency for sever AHI, the matter is different in correlation between DI and BMI, the study showed high significance correlation (P value = 0.00). Also the study showed significant correlation between DI and gender (P value = 0.00), in addition to significant correlation between AHI and gender (P value = 0.00). A study by Sonsuwan N et al mentioned that BMI, WC, and NC are parameters that associated with obesity. From the analysis, BMI was the factor that mostly correlated with AHI (correlation coefficient 0.604), and concluded that BMI, WC, and NC are correlated with AHI in OSA suspected Thai patients. BMI and WC, but not NC, were predictors for severity of OSA. [15] Another study by Arik B, et al demonstrated, AHI levels were weakly correlated with body mass index (r = 0.337, p = 0.004). [12] A study by Oztura I, et al showed females were more obese than males. BMI as the obesity index was correlated with AHI in both genders. This correlation was stronger in females than males. [13]

Philip P, et al study demonstrated that Distribution was not the same for men and for women regarding the DI, and a positive correlation between DI and BMI was observed for men (BMI increased from 24.3+/-3.3 kg/ m^2 in <5 DI class to 27.4=/-5.5 kg/ m^2 in >30 DI class; linear tendency test: P=0.003) but not for women (BMI, respectively, 25.3 +/- 4.0kg/ m^2 and 26.0 +/- 5.7 kg/ m^2; linear tendency test: P=0.99). [14]

Regarding correlation between AHI and basal SPO2 saturation, there was statistically significance correlation (p value = 0.04). Arik B, et al demonstrated, AHI levels were moderately correlated with basal oxygen saturation (r = −0.734, p < 0.001). [12] Another study by Sahin M, et al [16] also found correlation between AHI and basal SPO2 saturation.

CONCLUSION:

1. Desaturation index assessed by nocturnal pulse oximetry maintain its utility as a screening method in the recognition of obstructive sleep apnea in obese patients with high clinical pretest suspicion, despite the fact that basal nocturnal oxygen saturation is decreased in morbidly obese patients due to hypoventilation in supine position during sleep.
2. DI > 30 events/hour when combined with appropriate clinical evaluation, could be used as an initial diagnostic test for OSA.
3. BMI influence the accuracy of DI for the diagnosis of OSA.
4. Obesity remain a major risk factor and almost all suspected cases with OSA are obese.

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