Sleep Apnoea and its Relationship with Cardiovascular, Pulmonary, Metabolic and Other Morbidities

Abstract:
F Khan, C Walsh, SJ Lane, E Moloney
Peamount Hospital, Newcastle, Co Dublin

Sleep apnoea (OSAS) is a multisystem disorder. There is a high prevalence of cardiovascular and metabolic morbidities in patients investigated for sleep apnoea. We aim to evaluate any association between cardiovascular, metabolic and pulmonary co morbidities in patients investigated for OSAS and whether clinical findings based on ESS help in diagnosing sleep apnoea. A retrospective two years review of 258 consecutive patients who were electively admitted for sleep assessment in Peamount Hospital, Dublin from Sept 2009 to Aug 2011 was performed and analysed using statistical software R version 2.12 [cite R Development Core Team (2010). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/]. Patients admitted to the study included those that were more than 20 yr of age, symptoms of daytime somnolence, fatigue, snoring history, and obesity. PSG was performed on all patients to confirm OSAS diagnosis. All the patients underwent polysomnography (PSG). Standard overnight PSG was performed to document sleep parameters and architecture in each patient in a sleep laboratory. Variables are manually recorded in the quiet and darkened room.

Their PSG variables were calculated to formulate the diagnosis of sleep apnoea and categorize it accordingly. Apnoea is defined as more than 90 percent dropping of baseline airflow with continued chest wall and abdominal wall movement for a minimum of 10 sec, regardless of whether or not there was an associated oxygen desaturation or sleep fragmentation; baseline is defined as the mean amplitude of the three largest breaths in the two minutes preceding the onset of the event. The definition of hypopnoea was a 50 percent or greater reduction in airflow for a minimum of 10 seconds, associated with an equal to or greater than a 4 per cent drop in SpO2 or an EEG alpha wave arousal. The definition of desaturation episode was equal or more than a 4 per cent drop in SpO2, which was induced by apnoea or hypopnoea events. Apnoea hypopnoea index (AHI) was the number of apnoea plus hypopnoea events per hour of total sleep time, and desaturation index (DI) was the number of desaturation episodes per hour of total sleep time. AHI helps in defining and grading the severity of OSAS. An AHI of less than 5 is considered normal; 5-15 is mild; 15-30 is moderate; and more than 30 events per hour characterises severe sleep apnea. The medical notes of all 258 patients, who had PSG, were reviewed. Among them, we further analyzed the prevalence of cardiovascular diseases including Hypertension (HTN), Ischaemic Heart Disease (IHD), Valvular Heart Disease, Anemia; Pulmonary diseases including Asthma, Chronic Obstructive Pulmonary Disease (COPD); Hyperlipidaemia; Endocrinological diseases including Hypothyroidism, Diabetes; Gastroenterological diseases including Gastritis, Gastroesophageal Reflux Disease (GERD), Hiatus Hernia (HH), Peptic Ulcer Disease (PUD) and Depression.

The patients were divided in Sleep apnoea (OSAS) and non sleep apnoea (NON OSAS) group on the basis of their PSG variables as shown in Table 2. Of 258 patients, 139 (77.6% males, 22.3% females) are OSAS and 119 (47% males, 54% females) were NON OSAS. Cardiovascular, pulmonary and metabolic co morbidities were 46.12%, 37.2% and 29% respectively. There is no correlation found between ESS, Snoring with Apnoea Hypopnoea Index in OSAS group. Screening for OSAS should be considered in patients with certain cardiovascular and metabolic disorders. PSG is so far considered the gold standard investigation to diagnose OSAS and better clinical evaluating tools need to be formulated.

Methods
A retrospective two years review of 258 consecutive patients who were electively admitted for sleep assessment in Peamount Hospital, Dublin from Sept 2009 to Aug 2011 was performed and analysed using statistical software R version 2.12 [cite R Development Core Team (2010). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/]. Patients admitted to the study included those that were more than 20 yr of age, symptoms of daytime somnolence, fatigue, snoring history, and obesity. PSG was performed on all patients to confirm OSAS diagnosis. All the patients underwent polysomnography (PSG). Standard overnight PSG was performed to document sleep parameters and architecture in each patient in a sleep laboratory. Variables are manually recorded in the quiet and darkened room.

Their PSG variables were calculated to formulate the diagnosis of sleep apnoea and categorize it accordingly. Apnoea is defined as more than 90 percent dropping of baseline airflow with continued chest wall and abdominal wall movement for a minimum of 10 sec, regardless of whether or not there was an associated oxygen desaturation or sleep fragmentation; baseline is defined as the mean amplitude of the three largest breaths in the two minutes preceding the onset of the event. The definition of hypopnoea was a 50 percent or greater reduction in airflow for a minimum of 10 seconds, associated with an equal to or greater than a 4 per cent drop in SpO2 or an EEG alpha wave arousal. The definition of desaturation episode was equal or more than a 4 per cent drop in SpO2, which was induced by apnoea or hypopnoea events. Apnoea hypopnoea index (AHI) was the number of apnoea plus hypopnoea events per hour of total sleep time, and desaturation index (DI) was the number of desaturation episodes per hour of total sleep time. AHI helps in defining and grading the severity of OSAS. An AHI of less than 5 is considered normal; 5-15 is mild; 15-30 is moderate; and more than 30 events per hour characterises severe sleep apnea. The medical notes of all 258 patients, who had PSG, were reviewed. Among them, we further analyzed the prevalence of cardiovascular diseases including Hypertension (HTN), Ischaemic Heart Disease (IHD), Valvular Heart Disease, Anemia; Pulmonary diseases including Asthma, Chronic Obstructive Pulmonary Disease (COPD); Hyperlipidaemia; Endocrinological diseases including Hypothyroidism, Diabetes; Gastroenterological diseases including Gastritis, Gastroesophageal Reflux Disease (GERD), Hiatus Hernia (HH), Peptic Ulcer Disease (PUD) and Depression.

Results
The patients were divided in Sleep apnoea (OSAS) and non sleep apnoea (NON OSAS) group on the basis of their PSG variables as shown in Table 2. Of 258 patients, 139 (77.6% males, 22.3% females) are OSAS and 119 (47% males, 54% females) were NON OSAS. Cardiovascular, pulmonary and metabolic co morbidities were 46.12%, 37.2% and 29% respectively. There is no correlation found between ESS, Snoring with Apnoea Hypopnoea Index in OSAS group. Screening for OSAS should be considered in patients with certain cardiovascular and metabolic disorders. PSG is so far considered the gold standard investigation to diagnose OSAS and better clinical evaluating tools need to be formulated.
A statistician has been consulted and a multivariate model has been fitted to identify factors jointly associated with OSAS. In order to determine the factors that influence the presence of OSAS in a multivariate model, a backwards stepwise logistic regression was fitted. Factors entered included ESS, Smoking, Age, BMI and Gender. In the final model Age (p=0.001), OSA (p=0.001) and BMI (p=0.001) were statistically significantly associated with OSAS.

It is also analyzed that there is a relatively higher prevalence of depression 28/258, (10.8% vs. 8.5%) in all patients enrolled for PSG, as compared to the general population who do not have exhibiting risk factors for PSG enrolment. In addition, 54/258 (21%) of all high risk sleep apnoea patients suffer from gastrointestinal disorders. Singh et al 2006 described the prevalence of ESS was far considered changing the independent option to diagnose OSAS. In general, OSAS is more common in elderly and obese, male smokers. There is a higher prevalence of cardiovascular, pulmonary and metabolic co-morbidities in high risk sleep apnoea subjects.

**Discussion**

A large proportion of adult patients who are referred to sleep disorder centres have excessive daytime sleepiness. ESS is a simple, self administered questionnaire which provides a measurement of persons day time somnolence. The majority of patients (at least 90%) are unable to answer all of the ESS question stems. It may underestimate sleepiness severity in older subjects. In order to confirm the presence of upper-airway closure during sleep and to assess the patients CPAP pressure a full PSG is required.

Despite the large number of cross-sectional or case-controlled epidemiological studies, the issue of whether OSAS independently increases the risk of mentioned systemic diseases have been contentious. The development of sophisticated animal models will be required to explore pathophysiological mechanisms, and the collaboration of respiratory, cardiovascular, epidemiological, and clinical trials experts to examine the clinical consequences of diagnosing and treating OSAS. There is a higher prevalence of mentioned systemic diseases have been contentious. The development of sophisticated animal models will be required to explore pathophysiological mechanisms, and the collaboration of respiratory, cardiovascular, epidemiological, and clinical trials experts to examine the clinical consequences of diagnosing and treating OSAS.

**Metabolic disorders in OSAS**

OSAS has been studied and shown a close relationship between OSAS and increasing prevalence of hyperlipidaemia. There is 33.8% prevalence of hyperlipidaemia in OSAS population and it is independent of gender difference, likewise in our study a 27.3% prevalence is identified. There is 10.6% prevalence of more than one metabolic disorder including HTN, hyperlipidaemia and diabetes in patients suffering from OSAS, as compared to 13.1% in our Irish cohort.

Considering pulmonary complications in OSAS, Fleney described combination of COPD and OSAS as Overlapping syndrome [OS] which is characterised by hypoxia, hypercapnia, pulmonary arterial hypertension and nocturnal hypoxemia. It is estimated that 3% to 9% of the general population suffers about 325,000 people suffer from COPD in Ireland. In the European Union, general prevalence of COPD lies in the range of 4 - 10% as per EUPHIX summary in December 2009. COPD prevalence, in our sleep apnoea patients is 13.6%, which correlates closely to international findings. OSAS is an independent risk factor for COPD. Prevalence of COPD and it's complications in patients with OSAS is much lower than international standards at 17.2%. Justification of this may be due to diagnosis of sleep apnoea masking asthma diagnosis. Also, COPD may be over diagnosed instead of asthma as both are overlapping obstructive ventilatory defects.

Negative intrathoracic pressure in OSAS patients have been suggested as the underlying mechanisms of nocturnal gastro-oesophageal reflux diseases (GORD). Obesity is a common factor and a cause of the high prevalence of GORD in OSAS patients. It has also been described that the treatment of OSAS with nasal CPAP helps in improving nocturnal GORD symptoms. The frequency of asthma exacerbations and poor control in OSAS are neuromechanical reflex bronchospasm, gastroesophageal reflux disease, local and systemic inflammation and OSAS-induced cardiac dysfunction. There is a higher prevalence of OSAS symptoms in an asthmatic population (35.5%) when compared to a primary care population (27.2%). Interestingly, in comparison to our study prevalence of asthma in OSAS patients is much lower than international standards at 17.2%. This might be due to diagnosis of sleep apnoea masking asthma diagnosis. Also, COPD may be over diagnosed instead of asthma as both are overlapping obstructive ventilatory defects.

Despite the large number of cross-sectional or case-controlled epidemiological studies, the issue of whether OSAS independently increases the risk of mentioned systemic diseases have been contentious. The development of sophisticated animal models will be required to explore pathophysiological mechanisms, and the collaboration of respiratory, cardiovascular, epidemiological, and clinical trials experts to examine the clinical consequences of diagnosing and treating OSAS. There is a higher prevalence of mentioned systemic diseases have been contentious. The development of sophisticated animal models will be required to explore pathophysiological mechanisms, and the collaboration of respiratory, cardiovascular, epidemiological, and clinical trials experts to examine the clinical consequences of diagnosing and treating OSAS.

**References**


3. Romero-Corral A, Caples SM, Lopez-Jimenez F, Somers VK. Interactions Between Obesity and Obstructive Sleep Apnea Hypopnea Syndrome CHEST March 2010 vol.137 no. 3 711-719


Correspondence: P Khan

AMWCC, Tallaght, Dublin 24
Email: drfaheemkhan@gmail.com

DOI: 10.1056/NEJM199304293281704


DOI: 10.1056/NEJM199304293281704