Obstructive Sleep Apnoea and Atopy Among Middle Aged Chronic Obstructive Pulmonary Disease and Bronchial Asthma Patients

Raj Kumar*, Devender Nagar**, Adeeb Mallick**, Manoj Kumar***, Chandrakant R Tarke****, Nitin Goel†

Abstract

Background: Obstructive sleep apnoea syndrome is associated with significant morbidity. A high prevalence of obstructive sleep apnoea (OSA) symptoms has been reported in patients with asthma and chronic obstructive pulmonary disease (COPD). There are limited studies regarding relationship between atopy and OSA.

Objective: To study the risk of obstructive sleep apnoea among middle aged chronic obstructive pulmonary disease and asthma patients by a home based sleep study and its association with atopy.

Methods: Patients with asthma and COPD were evaluated for OSA symptoms by Epworth sleepiness scale (ESS) and Berlin questionnaire (BQ). ESS score ≥9 was considered as high risk for OSA. Patients having high risk for OSA by ESS and BQ were further evaluated for OSA by home based sleep study. Skin prick test against common allergens was done to diagnose atopy in these patients.

Results: Among 400 patients (229, 57.25% male and 171, 42.75% female) 328 were asthmatics and 72 were COPD patients. ESS and BQ was positive in 11.25% (45/400) and 18.25% (73/400) patients respectively. ESS was positive in 10.67% (35/328) of asthma and 13.88% (10/72) of COPD patients. BQ was positive in 18.29% (60/328) of asthmatic and 18.05% (13/72) of COPD patients. Skin prick test was positive in 74.16% patients. The maximum positivity was found in asthmatics (139/155, 89.68%) compared to COPD patients (16/155, 10.32%). Skin prick test was done for 40 patients out of 73 of Asthma and COPD patients who were found positive by ESS and BQ. 72.5% patients were found to be atopic. Out of 19 patients in whom home polysomnography was done, 13 patients consented for skin prick test with common aeroallergens and 9 (69.23%) patients were found to be atopic.

Conclusions: There is an increased risk of obstructive sleep apnoea among middle aged chronic obstructive pulmonary disease and asthma patients. Atopy could be associated with OSA. The association needs to be proved in a larger study.

Introduction

Sleep disorders include a spectrum of conditions, the most severe of which is obstructive sleep apnoea syndrome (OSAS). It is a potentially disabling condition characterised by disruptive snoring, repeated episodes of complete or partial pharyngeal obstruction during sleep resulting in nocturnal hypoxaemia, frequent arousals and excessive daytime sleepiness. OSA is a leading public health problem both in the developed and developing nations. However, awareness regarding diagnostic options, management and consequences of untreated OSA remains inadequate. In developing nations, the resources for adequate sleep medicine facilities are scarce. Therefore, there is a need for low cost, simple and accurate diagnostic and therapeutic modalities.

Asthma is an inflammatory disease of the lower respiratory tract, manifesting as intermittent constriction of the bronchial airways. COPD, on the other hand, is a state-dependent condition that is characterised by intermittent obstruction of the upper airway during sleep. A high prevalence of OSA symptoms was reported in patients with asthma. A relationship between asthma and OSA was noted >25 years ago. Hudgel and Shucard described severe hypoxaemia in coexistent asthma and OSA. Fitzpatrick et al. noted that 11% of asthmatic patients reported frequent snoring (i.e., >4 nights a week) and frequently reported falling asleep while driving or operating machinery.

COPD is a prevalent progressive condition that adversely affects quality of life and sleep. Patients with COPD suffer from variety of sleep disorders including insomnia, sleep disordered breathing and restless leg syndrome. Both COPD and sleep apnoea-hypopnoea syndrome (SAHS) are common diseases, and many individuals would be expected to have both conditions by chance alone. It has been believed that the presence of COPD could predispose to the development of SAHS, since the two conditions share some aetiological factors such as tobacco smoking.

Atopy is a major risk factor for OSAS. Atopy is frequent among obstructive sleep apnoea patients undergoing skin prick testing and polysomnography. Atopy was the strongest risk factor for habitual snoring in a study done on Singapore children. Kalra et al. found high prevalence of snoring in young women with atopy. There are limited studies regarding relationship between atopy and OSA.

Material and Methods

A total of 400 patients (328 asthmatics and 72 COPD) who presented in one unit OPD of Vallabhbaith Patel Chest Institute, New Delhi, India, were included in the study. The diagnosis of Asthma was based on the GINA guidelines (reversibility of more than 12% or increase of 200 ml in FVC or FEV1 after 200 microgram of inhaled salbutamol) and of COPD as per GOLD guidelines. The written consent was taken from the patient after explaining the procedure. Ethical clearance from the institutional
Obstructive sleep apnoea (OSA) is a highly prevalent disease, affecting 4% of men and 2% of women, and strongly linked to the current obesity epidemic. The disorder is characterised by recurrent episodes of upper airway obstruction, and is associated with reductions in ventilation, resulting in recurrent arousals and episodic oxyhaemoglobin desaturations during sleep. Significant clinical consequences of the disorder cover a wide spectrum including daytime hypersomnolence, neurocognitive dysfunction, cardiovascular disease (hypertension, stroke, myocardial infarction, heart failure), metabolic dysfunction, respiratory failure, and cor pulmonale. The major risk factors for the disorder include hypertension, stroke, myocardial infarction, heart failure, metabolic dysfunction, respiratory failure, and cor pulmonale.

### Statistical analysis

Statistical analysis was done by SPSS software.

## Results

A total of 400 (229, 57.25% male and 171, 42.75% female) patients of COPD and Asthma were studied from January, 2010 to February, 2011. Maximum number of patients belonged to 31-40 years (93, 23.25%) age group followed by 41-50 years (82, 20.50%) and 21-30 years (74, 18.50%). 328 patients were asthmatics comprising of 169 (51.52%) males and 159 (48.47%) females. There were 72 COPD patients which included 60 (83.33%) males and 12 (16.67%) females.

The mean duration of illness of Asthma and COPD was 7.9 years and 7.7 years respectively. Patients of Asthma and COPD had rhinitis in 54.26% (178/328) and 59.72% (43/72) respectively.

### Discussion

Obstructive sleep apnoea (OSA) is a highly prevalent disease, affecting 4% of men and 2% of women, and strongly linked to the current obesity epidemic. The disorder is characterised by recurrent episodes of upper airway obstruction, and is associated with reductions in ventilation, resulting in recurrent arousals and episodic oxyhaemoglobin desaturations during sleep. Significant clinical consequences of the disorder cover a wide spectrum including daytime hypersomnolence, neurocognitive dysfunction, cardiovascular disease (hypertension, stroke, myocardial infarction, heart failure), metabolic dysfunction, respiratory failure, and cor pulmonale. The major risk factors for the disorder include...
Table 2: Berlin Questionnaire evaluation results

<table>
<thead>
<tr>
<th>Berlin Questionnaire</th>
<th>Bronchial Asthma</th>
<th>COPD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. High risk: Two or more category where score is positive</td>
<td>60 (18.29%)</td>
<td>13 (18.05%)</td>
<td>73 (18.25%)</td>
</tr>
<tr>
<td>b. Low risk: One or no category where score is positive</td>
<td>268 (81.70%)</td>
<td>59 (81.94%)</td>
<td>327 (81.75%)</td>
</tr>
<tr>
<td>Total</td>
<td>328</td>
<td>72</td>
<td>400</td>
</tr>
</tbody>
</table>

Table 3: Skin Prick Test results

<table>
<thead>
<tr>
<th>Skin Prick Test result</th>
<th>Bronchial Asthma</th>
<th>COPD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Positive</td>
<td>139 (75.95%)</td>
<td>16 (61.53%)</td>
<td>155 (74.16%)</td>
</tr>
<tr>
<td>ii. Negative</td>
<td>44 (24.04%)</td>
<td>10 (38.46%)</td>
<td>54 (25.83%)</td>
</tr>
<tr>
<td>Total</td>
<td>183</td>
<td>26</td>
<td>209</td>
</tr>
</tbody>
</table>

obesity, male gender, postmenopausal status, and age etc.\textsuperscript{26-28} The rising prevalence of obesity in the United States suggests that OSA will represent an escalating public health burden.\textsuperscript{29} Therefore, knowledge and understanding of the pathogenic basis, clinical presentation, and diagnosis of OSA are essential for the development of preventive, screening, and therapeutic strategies to reduce the public health burden of the disorder.

Although Polysomnography remains the gold standard for diagnosis of OSA, ESS\textsuperscript{30} and Berlin Questionnaire\textsuperscript{31} are proven subjective tools for OSA assessment. Hence, we used ESS and Berlin Questionnaire for classifying the patients at risk for OSA and undertake home sleep study in them. Home based sleep study has several advantages over sleep-laboratory polysomnography, like patient is able to sleep in a familiar environment, with fewer monitor leads and has probably lesser sleep disruptions. Simultaneously, it is convenient for patients with transportation problems, along with benefit of being less complex technically and lower cost.\textsuperscript{30}

A high prevalence of OSA symptoms has been reported in patients with asthma. Large epidemiologic studies demonstrate that asthma patients more frequently report snoring.\textsuperscript{32,33} In a longitudinal study, asthma was an independent risk factor for development of snoring.\textsuperscript{33} OSA symptoms are highly prevalent in clinic-based populations of well-characterised asthma patients.\textsuperscript{34,35} Polysomnography revealed high frequencies of OSA (88% and 95.5%) in patients with difficult-to-control asthma.\textsuperscript{36,37} Conversely, OSA could worsen asthma. Treatment for OSA improves asthma symptoms.\textsuperscript{38-40} Use of rescue bronchodilator, peak expiratory flow rates,\textsuperscript{38} and disease-specific quality of life.\textsuperscript{4} This study demonstrated similar results. ESS and Berlin questionaire was positive in 10.67% and 18.29% of asthma patients respectively.

The association of COPD and sleep apnoea syndrome, which are both frequent diseases, is likely to occur in a number of patients. OSA shares several important features with COPD, as follows: 1) OSA affects 4-6% of all middle aged males and 2% of middle-aged females, with percentages similar to COPD.\textsuperscript{41,2} 2) It is now appreciated by several well controlled epidemiological studies that, 20% of patients with OSA will have COPD,\textsuperscript{43} and, 10% of OSA is disclosed in COPD patients independently of the degree of functional status.\textsuperscript{44,3} In 63% of OSA patients a history of smoking is recorded, which is a predisposing factor for both OSA and COPD.\textsuperscript{45} 4) With regard to the cardiac and metabolic effects often reported in COPD, right cardiac failure and co-morbidities in the left heart, including congestive failure and systemic hypertension, are often observed in OSA patients.\textsuperscript{46} This study demonstrated similar results. ESS and Berlin questionnaire was positive in 13.88% and 18.05% of COPD patients respectively.

In a large population-based cohort of young atopic women, Kalra et al\textsuperscript{7} found a 20.5% prevalence of habitual snoring (≥3 nights per week). We have studied occurrence of atopy in patients who were positive for OSA by Epworth sleepiness scale and Berlin questionaire. We found that skin prick test with common aeroallergens was positive in 72.5% patients. This result was comparable to the results found by Rochford et al\textsuperscript{5} in which they found that 74% of subjects with OSA undergoing skin prick test were atopic. Although inability to confirm OSA in these patients by sleep study (due to denial for the same by the patients) was a limitation of our study, still 75% of COPD (6 out of 8 who consented for SPT) and 71.8% of Asthma (23 out of 32 patients who consented for SPT) patients were atopic and had high risk of OSA as per ESS and Berlin questionnaire. Again since the patients proven to have OSA by sleep study belonged to Asthma group only, the association of atopy with Asthma remains a limiting factor. Also, non-exclusion of other confounding factors like obesity that have known association with OSA, remains another limitation of the present study.

To the best of our knowledge, still there is no significant research study available elucidating the mechanisms of association of OSA with atopy. Probably the inflammatory mediators elevated in patients with atopy may play a role in alterations in the soft tissues of upper airway which will predispose to development of OSA. Further research is required to discover the underlying mechanisms.

In conclusion, it was observed that an increased risk of OSA was present in Asthma and COPD patients. There was high occurrence of atopy (72.5%) among patients who were considered high risk for OSA by Berlin Questionnaire method. Atopy could hence, be associated with OSA. The association needs to be proved in a larger study.

Acknowledgements

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References
1. Hudgel DW, Shucard DW. Coexistence of sleep apnea and asthma resulting in severe sleep hypoxemia. *JAMA* 1979;242:2789–2790.