Original Article

Study of correlation between obstructive sleep apnea and obstructive airway disease

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Abstract

Background: The association between OSA and obstructive airway disease (OAD), including both asthma and chronic obstructive pulmonary disease (COPD) has been studied previously. A high prevalence of OSA has been reported in asthma cases. Sleep related symptoms do also occur in patients of COPD. This study was undertaken to find the correlation between obstructive sleep apnea and obstructive airway disease, with the help of spirometry and polysomnography. **Material and Methods:** The present study was conducted in sleep laboratory on 114 patients of COPD, bronchial asthma and obstructive sleep apnea. Baseline spirometry was done with computerized Medgraphics Spirometer and divided as per post bronchodilator FEV1reversibility as, those with asthma and with COPD. Asthma was diagnosed on the basis of Global Initiative for Asthma guidelines (GINA) and COPD based on Global Initiative for obstructive lung Disease guidelines. The apnea-hypopnea index was used to quantitate the severity of obstructive sleep apnea. **Results:** Amongst patients with COPD and asthma, majority had moderate to severe COPD. Amongst COPD and asthma patients, 22 (28.20%) and 12 (33.33%) patients were found to have obstructive sleep apnea. In patients having severe OSA, (10out 12 patients) had more severe grade of bronchial asthma with FEV1 <80%. This suggest that presence of asthma may lead to worsening of sleep apnea and vice versa. **Discussion:** In patients having overlap syndrome had more severe (50.59) hypercapnia, and nocturnal desaturation (mean 85.88%). Patients having moderate COPD had severe OSA. Patients having severe asthma had severe OSA with correlation coefficient of -0.676.
Key Words: Obstructiveair way disease, Bronchial asthma, Obstructive sleep apnea.

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INTRODUCTION

Sleep is a natural periodic state of rest for the mind and body, in which the eyes usually close and consciousness is completely or partially lost so that there is a decrease in bodily movement and responsiveness to external stimuli.[1] It is said that "sleep is reward for some, a punishment for other." Obstructive sleep apnea (OSA) is leading public health problem in developed and developing nations. However, awareness regarding diagnostic options, management and consequences of untreated OSA remains inadequate in developing nation. Untreated OSA leads to excessive daytime sleepiness, diminished performance and overall poor quality of life. Sleep disordered breathing (SDB) includes a spectrum of conditions including snoring, upper airway resistance syndrome (UARS) and OSA. The most severe of which is obstructive sleep apnea syndrome (OSAS) it is potentially disabling condition characterized by disruptive snoring, repeated episodes of complete or partial pharyngeal obstruction during sleep resulting in nocturnal hypoxemia, frequent arousals and excessive day time sleepiness.[2] Prevalence of OSA varies in different population. In most of the studies it varies from 3-7%. In India prevalence of obstructive sleep apnea is 7.5% in males and that of 4.5% in females.[3] Several studies have investigated the association between OSA and obstructive airway disease (OAD), including both asthma and chronic obstructive air way disease (COPD). A high prevalence of

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OSA has been reported in asthma cases[4] and asthma may also be common in OSA.[5] Sleep related symptoms do also occur in patients of COPD. Whenever both these condition present together is called "Overlap Syndrome." It is not surprising that research attentions have focused on the overlap syndrome between these two highly prevalent conditions with the aim of determining their relationship. In patients with COPD, studies have shown that as the depth of sleep increases, there is a reduction in minute ventilation with an increase in upper airway resistance[6] with up to 20% patients of severe COPD exhibiting co-existent OSA[7]. The observation by Kreiger and Colleagues[8] that the severity of airway obstruction, as evidenced by FEV1/FVC ratio, was directly proportional to severity of OSA. Patients with overlap have a more important sleep related oxygen desaturation. They have an increased risk of developing hypercapneic respiratory insufficiency and pulmonary hypertension.[8] This study was undertaken to find the correlation between obstructive sleep apnea and obstructive airway disease, with the help of spirometry and polysomnography.

MATERIAL AND METHODS

The present study was conducted in sleep laboratory of the Department of Medicine of a tertiary care hospital that caters to population of diverse groups. All patients of COPD and bronchial asthma diagnosed as per guidelines and those fulfilling the criteria for diagnosis of obstructive sleep apnea were included in the study. Previously diagnosed cases of COPD and bronchial asthma (as per guidelines) having symptoms of obstructive sleep apnea were also included in this study. Patients after clinical examination and spirometry with post bronchodilator reversibility were categorized into bronchial asthma and COPD. Subsequently, polysomnography was done of these patients to find out presence of OSA. Patients under 13 years of age having chronic lung diseases not satisfying guidelines for diagnosis of COPD, bronchial asthma and OSA, patients admitted with life threatening conditions like acute respiratory failure, critical metabolic acidosis, altered sensorium, hypotension, left ventricular failure and with Acute exacerbation of COPD/bronchial asthma, acute myocardial infarction and acute stroke were excluded from the study. All the patients included in the study were interviewed for demographic data and detail history of their illness. All selected patients were subjected to detail physical examination. After physical examination and investigations, an informed consent was obtained from all the patients. Patients were also instructed about the procedure in detail prior to testing and were also positioned in a proper way. In all patients, baseline spirometry was done with computerized Medgraphics Spirometer. This spirometer met American thoracic society criteria[10] and was volume calibrated daily. Measurement accuracy of spirometer was ±2%. The patient was subjected to spirometric study in pulmonary function test (PFT) laboratory. Bronchodilator response was assessed by giving nebulized salbutamol in a dosage of 2.5 mg (0.5 ml) diluted with 2ml. 0.9% normal saline (available as 5 mg/ml). Spirometry was performed after 15 minutes of nebulization with salbutamol. The best of three consecutive measurements were taken. After spirometry patients were differentiated as those with good bronchodilator response, those with poor bronchodilator response, mixed ventilator disorder and normal spirometry[11]. Asthma was diagnosed on the basis of Global Initiative for Asthma guidelines (GINA). Diagnosis of COPD was based on Global Initiative for obstructive lung Disease guidelines. Patients with mixed ventilator disorder were also included in COPD patients, as all of them had poor bronchodilator response on Spirometry[12]. COPD patients were further staged as mild, moderate, severe, very severe as per the GOLD guidelines[13]. The apnea-hypopnea index (AHI-the number of apneas plus hypopneas per hour of sleep) is the standard metric used to quantitate the severity of obstructive sleep apnea[14]. Although, the AHI has been proven to be superior metric when assessing the overall effect of OSA, it excludes the degree of oxygen desaturation, degree of hypoventilation, and total number of arousals. An AHI greater than 5 to 10 events/hrs indicative of OSA. The OSAS is said to be present when the AHI is greater than 5 to 10 events/hr and the patient has symptoms of excessive daytime somnolence, unrefreshing sleep, or chronic fatigue. Polysomnography is a comprehensive recording of the biophysiological changes that occur during sleep it was performed with EMBLA 7000 Polysomnography machine having multiple channels[14]. Every patient admitted in the sleep laboratory underwent polysomnography in the evening at 8 pm after taking informed consent. Detail procedure was explained to the patient and patient was introduced to the settings and then "wired-up" to record multiple channels of data during sleep. During the procedure sleep activity was observed by looking at the video monitor and the computer screen that displayed all data second by second. This test was completed in 6-8 hrs and patient was discharged at 7 am. On completion of the procedure, results were interpreted by reviewing the study in 30 second epoch's.

RESULTS

A total of 114 patients of COPD, bronchial asthma and obstructive sleep apnea who satisfied all the inclusion criteria attending a tertiary care center were studied.

Patients included in the present study were divided after spirometry as per post bronchodilator FEV1reversibility as, those with asthma (>12% or 200 ml reversibility in FEV1) and those with COPD (<12% reversibility or 200 ml in FEV1). Amongst total 114 patients, 78(68.42%) were of COPD and 36(31.58%) were of bronchial asthma. Majority of patients having COPD were in the age group of 45-54 years and 55-64 years, 44.87%, while majority of patients having bronchial asthma were in the age group of 35-44 years 44.40%. In the total study population of 114 patients, 80 (70.17%) were males and 34(29.82%) were females. Amongst 78 COPD patients, 59(75.64%) were males and 19(24.35%) were females. Amongst 36 patients with asthma, 21 (58.33%) were males and 15 (41.66%) were females. Amongst patients with COPD, 12 (15.38%) had mild COPD, 30 (38.46%) had moderate COPD, 26 (33.33%) had severe COPD and 10 (12.82%) patients had very severe COPD. Amongst asthma patients, 13 (36.11%) and 12 (33.33%) patients had moderate and severe asthma respectively. Again 6 (16.67%) and 5 (13.89%) patients had mild persistent and intermittent asthma respectively. A total of 22 (28.21%) patients of COPD had OSA and 12 (33.33%) patients of asthma had OSA.

Table 1: Comparison of spirometric, ABG and polysomnographic parameters of patients having COPD and overlap syndrome

Characteristic	COPD only (n = 56)	COPD with OSA (n = 22)
BMI (mean)	23.24	33.20
Mean PO2 (mmHg)	72.25	70.33
Mean PaCO2 (mmHg)	47.75	50.59
Lowest nocturnal saturation (Mean SaO2 %)	91.23%	85.88%
FEV1 (mean %)	50.5%	42.7%

Patients of overlap syndrome were having higher BMI (33.20) than that of COPD alone (23.24). Patients with overlap syndrome were having more severe hypercapnia (mean $PaCO_2$ 50.59) than that of COPD alone (mean $PaCO_2$47.75). Patients with overlap syndrome were having more severe nocturnal desaturation (mean 85.88%) than COPD alone (mean 91.23%). Mean FEV1of patients having overlap syndrome was 42.7% versus 50.5% in patients of COPD alone (Table 1). Out of 22 patients of obstructive sleep apnea, 13 (59.09%) patients had severe COPD, 06 (27.27%) patients had moderate COPD and 03 (13.64%) patients had very severe COPD (Table 2).

Table 2: Correlation of severity of OSA with COPD (n=22)

	Mild COPD	Moderate COPD	Severe COPD	V. Severe COPD
Mild OSA	00	03	00	00
Moderate OSA	00	03	12	02
Severe OSA	00	00	01	01
Total	**00(00%)**	**06(27.27%)**	**13(59.09%)**	**03(13.64%)**

Out of 12 patients of obstructive sleep apnea 07 (58.33%) had severe asthma, 03 patients (25%) had moderate asthma and 02 patients (16.67%) had mild asthma. This suggest that severity of asthma is one of the predictor of severity of OSA in patients of bronchial asthma. It was also observed that in patients having severe OSA, 10 out 12 patients had more severe grade of bronchial asthma. FEV1<80%. (Table 3).

Table 3: Correlation of severity of OSA with bronchial asthma (n=12)

	Mild Asthma (FEV1 > 80%)	Moderate Asthma (FEV1 60 80%)	Severe Asthma (FEV1 <60)
Mild OSA	01	00	00
Moderate OSA	01	03	02
Severe OSA	00	00	05
Total	**02 (16.67%)**	**03 (25%)**	**07 (58.33%)**

DISCUSSION

COPD and bronchial asthma are common clinical problems. COPD is currently the fourth leading cause of death worldwide[15]. Poor sleep has classically been reported among both COPD and asthma patients[16]. Therefore, many practitioners may attribute sleep difficulties or sleep symptoms to these respiratory diseases rather than investigate for obstructive sleep apnea. Prevalence of overlap syndrome that is association of COPD and OSA and bronchial asthma patients having OSA is also on rise and we intended to study correlation between obstructive sleep apnea and obstructive airway disease in the present study population. In the present study, patients having COPD were more 78 (68.42%) than that of bronchial asthma (31.58%). In similar studies done by Seemungal *et al* observed that patients having COPD were more in number (62.97%) than bronchial asthma (37.08%)[17]. In another study done by Gothi *et al*, 169 (63%) had asthma, 46 (17%) had COPD, 15 (6%) had bronchiectasis, 36 (13%) obliterative bronchiolitis and 2 (1%) suffered from occupational airway disease[18]. The mean age of the patients with COPD was 53.98 years and that of asthma patients was 37.33 years in present study. Gothi *et al* found that mean age of COPD patients was 54 years and that of asthma was 38 years[18]. In the study done by Seemungal *et al*, mean age of COPD patients was 60.3 years and that of asthma was 47.8 years[17]. Mean age of the patients with COPD and asthma in present study correlates with Gothi *et al* study[18]. In the present study, amongst COPD patients 59 (75.64%) were male and 19 (24.35%) were female, male: female ratio in COPD was 3.1:1 as amongst patients with asthma 21 (58.33%) were male and 15 (41.67%) were female, with

male to female ratio of 1.4:1. In the study done by Jindal *et al* in COPD patients including 1475 males and 1329 females in the year 1993 male to female ratio was 1.56:1[19]. In another study done by Mathur *et al* on 1200 patients male to female ratio was 1.6:1[20]. In the study by Gupta *et al* on 6530 patients, 54.5% patients were male and 45.5% were females and male to female ratio was 1.19:1[21]. Findings in the present study correlate with above mentioned studies in which male were more than female both in COPD as well as in bronchial asthma. Amongst patients with COPD, most of the patients had moderate to severe disease. Present study findings correlate with Seemungal *et al* study[17]. Again 16.67% and 13.89% patients had mild persistent and intermittent asthma respectively. In the study done by Gothi *et al*, on patients of bronchial asthma on 268 patients found that 42% patients had mild asthma, 35% patients had moderate asthma and 22% patients had severe asthma[18]. In the study done by Yuan Yuan *et al* on patients of bronchial asthma on 176 patients found that most of the patients had mild to moderate asthma[22]. Out of 22 patients of COPD with OSA (overlap syndrome) 06 (27.27%) patients had moderate COPD, 13 (59.09%) patients had severe COPD and 03 (13.64%) patients had very severe COPD. We could not find similar studies on extensive search of literature to compare our results. We observed that patients with overlap syndrome of COPD and OSA were having mean BMI of 33.2 and that of COPD alone was 23.24. The patients of overlap syndrome were having more severe nocturnal desaturation (mean 85.88%) than COPD alone (mean 91.23%). Patients with overlap syndrome were having more severe hypercapnia (mean $PaCO_2$50.59) than COPD alone (mean $PaCO_2$ 47.75). Mean FEV1of the patients of overlap syndrome was 42.7% versus 50.50% in COPD alone. This implies that overlap syndrome may lead to severe degree of hypoxemia and hypercapnia, and more severe nocturnal desaturation in present study. Similar fact was mentioned by Krygerin his textbook of sleep medicine[23]. In the present study, out of 12 patients of obstructive sleep apnea 7 (58.33%) were having severe asthma, 3 patients (25%) were having moderate asthma, and 02 patients (16.67%) were having mild asthma. This suggest that in the present study severity of asthma is one of the predictor of severity of OSA. It was also observed that in patients having severe OSA, (10 out 12 patients) had more severe grade of bronchial asthma FEV1<80%. This may be due to asthma worsening sleep apnea and vice versa. One of the studies done by Teodorescu *et al* concluded that risk for OSA in patients with asthma was predicted by severity of bronchial asthma. It was also concluded that patients who have difficulty achieving adequate asthma control should be screened for obstructive sleep apnea[24]. In the study done by Julien *et al* concluded that OSA is more prevalent in patients of severe asthma than mild or moderate asthma[25]. In a review by Alkhalil, it was concluded that OSAS can worsen asthma and vice-versa, and outlined potential etiologies for this interaction. OSAS is an independent risk factor for asthma exacerbations and that OSAS symptoms are more common in asthmatic patients than in the general population[26]. Theco-occurrence of COPD and OSAS, also referred to as the overlap syndrome, in volvesa minority of COPD patients, but identifying these patients is important because he irnocturnalhy poxemiatends to be more pronounced, leading to a greater likelihood of adverse clinical events. It follows that in patients with the overlap syndrome, therapy must be directed at both the COPD and the OSAS. Linear correlation was observed between severity of obstructive sleep apnea (AHI) and asthma.

REFERENCES

1. The American Heritage® Medical Dictionary Copyright © 2007.
2. Sharma H, Sharma SK.Overview and implications of obstructive sleep apnea. Ind J Chest Dis Allied Sci2008; 50:137-150.
3. Udwadia ZF, Doshi AV, Lonkar SG, Singh CI. Prevalence of sleep disordered breathing and sleep apnea in middle aged urban Indian men. Am J RespirCrit Care Med 2004; 169:168-173.
4. Auckley D, Moallem M, Shaman Z, Mustafa M. Findings of a Berlin Questionnaire survey: comparison between patients seen in an asthma clinic versus internal medicine clinic. Sleep Med 2008; 9:494-499.
5. Alharbi M, Almutairi A, Alotaibi D, Alotaibi A, Shaikh S, Bahammam AS. The prevalence of asthma in patients with obstructive sleep apnoea. Prim Care Respir J 2009; 18:328-330.
6. Ballard RD, Clover CW, Suh BY. Influence of sleep on respiratory function in emphysema. Am J RespirCrit Care Med. 1995 Apr; 151(4):945-51.
7. Brander PE, Kuitunen T, Salmi T, Partinen M. Nocturnal oxygen saturation in advanced chronic obstructive pulmonary disease after a moderate dose of ethanol. EurRespir J. 1992 Mar; 5(3):308-12.
8. Krieger AC, Patel N, Green D, Modersitzki F, Belitskaya-Levy I, Lorenzo A, Cutaia M. Respiratory disturbance during sleep in COPD patients without daytime hypoxemia. Int J Chron Obstruct Pulmon Dis 2007; 2(4):609-15.
9. Hart N. Do COPD patients that snore have an increased risk of obstructive sleep apnea. Int J Chron Obstruct Pulmon Dis 2007; 400-401.
10. American Academy of Sleep Medicine. AASM Manual for the scoring of sleep and associated events: rules, terminology, and technical specifications. American Academy of Sleep Medicine; Darien, IL: 2007.

11. Mottram C. Spirometry. In: Ruppel's Manual of Pulmonary Function Testing. 10thed, Elsevier publication, USA. 2013.
12. Global Initiative for Asthma (GINA) Scientific Committee. [Accessed 17 Sept 2010] Global strategy for asthma management and prevention. 2007. Available at http://www.ginasthma.com/download.asp?intId=411.
13. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2017 Report www.goldcopd.org (Accessed on March 5, 2017).
14. Rechtschaffen A, Kales A. (Eds.) A manual of standardized terminology, techniques and scoring system for sleep stages of human subjects. 1968. Washington DC: Public Health Service, U.S. Government Printing Service.
15. Murthy KJR, Sastry JG. Economic burden of chronic obstructive pulmonary disease: NCMH Background Papers- Burden of Disease in India, 2005. Available online:http://whoindia.org/LinkFiles/Commision_on_Macroeconomic_and_Health_Bg_P2_Economic_burden_of_chronic_obstructive_pulmonary_disease.pdf
16. Straus SE, McAlister FA, Sackett DL, Deeks JJ, On Behalf of the CARE-COAD2 Group. Accuracy of History, Wheezing, and Forced Expiratory Time in the Diagnosis of Chronic Obstructive Pulmonary Disease. J Gen Intern Med 2002; 17(9):684-688.
17. Seemungal T, Harrinarine R, Rios M, Abiraj V, Ali A, Lacki N, et al. Obstructive lung disease in acute medical patients. West Indian Med J 2008 Jan;57(1):7-13.
18. Gothi D, Shah DV, Joshi JM. Clinical Profile of Diseases Causing Chronic Airflow Limitation in a Tertiary Care Centre in India. JAPI2007;55:551-5.
19. Jindal SK. Emergence of chronic obstructive pulmonary disease as an epidemic in India. Indian J Med Res. 2006 Dec; 124(6):619-30.
20. Mathur US, Virendra Singh, Ramchandani GD. Clinical profile of patients with asthma in Rajasthan. Lung Ind 1993; 14(2):135-138.
21. Gupta SK. Clinical Profile of Bronchial Asthma in Eastern India - A Prospective Analysis Of 7208 Patients. Lung Ind 1996; 14(2):60-65.
22. YuanYuan L, XianSheng L, YongJian X. Basic and clinical research into chronic obstructive pulmonary. Chin Med J (Beijing) 2010; 123(4):491-497.
23. Kryger M,Roth T,Dement W. Principles and Practice of Sleep Medicine. 5th Edition. Elsevier publication, USA.
24. Teodorescu M, Consens FB, Bria WF, Coffey MJ, McMorris MS, Weatherwax KJ, et al. Predictors of habitual snoring and obstructive sleep apnea risk in patients with asthma. Chest. 2009; 135:1125-1132.
25. Julien JY, Martin JG, Ernst P, Olivenstein R, Hamid Q, Lemière C, Pepe C, et al. Prevalence of obstructive sleep apnea-hypopnea in severe versus moderate asthma. J Allergy ClinImmunol 2009; 124(2):371-6.
26. Alkhalil M, Schulman E, Getsy J. Obstructive Sleep Apnea Syndrome and Asthma: What Are the Links? J Clin Sleep Med 2009; 5(1):71-78.

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