www.jmscr.igmpublication.org
Impact Factor (SJIF): 6.379
Index Copernicus Value: 71.58
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossrefDOI: https://dx.doi.org/10.18535/jmscr/v6i7.89

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Original Article

Sleep Quality and Pattern in Relation to the Severity of Chronic Obstructive Pulmonary Disease

Authors
Dr Suresh Patil[1], Dr Sarang Patil[2]
[1]Associate Professor, Department of Pulmonary Medicine, ACPM Medical College, Dhule, Maharashtra
[2]Junior Resident, Department of Pulmonary Medicine, Dr D.Y. Patil Medical College, Nerul, Navi Mumbai
Corresponding Author
Dr Sarang Patil
Junior Resident, Dept. of Pulmonary Medicine
Dr. D.Y. Patil Medical College, Nerul, Navi Mumbai (400706), Maharashtra, India

Abstract
Introduction: *Patients with chronic obstructive pulmonary disease (COPD) frequently suffer from nocturnal alterations in gas exchange. The aim of the present study was to observe and describe the sleep pattern and quality in patients with varying severity of COPD.*
Methodology: *In this observational study we included all cases of known stable or newly diagnosed COPD on spirometry as per GOLD criteria with or without complaints of changes in sleep pattern or quality from January 1, 2018 till April 30, 2018. Demography, past medical history, clinical presentation and anthropometry were noted. Polysomnography was performed using standard techniques and manually analysed.*
Results: *During the study period a total of 168 patients were included; 67% males and mean age 64.2 years. Mean sleep efficiency in mild COPD was 82.7%, moderate COPD was 83.1 % and in severe COPD was 94.3%. Sleep latency was decreased in severe COPD patients, normal in mild and moderate COPD. Mean duration of Stage N1 was 12.9%, 20.1% and 14.32% in mild, moderate and severe COPD respectively. Mean duration of Stage N2 was 30.2%, 32.1% and 42.6% in mild, moderate and severe COPD respectively. Mean duration of Stage N3 in mild COPD was 52%, in moderate COPD was 36.2% and in severe COPD was 25.5 % of total sleep time. Further, we observed that the mean duration of Stage R in mild COPD was 4.6 %, in moderate COPD was 3.7 % and in severe COPD was 5.9 % of total sleep time.*
Conclusions: *Clinicians need to be aware about the decreased quality of sleep in COPD patients. Good sleep hygiene and measures to improve sleep quality will help to improve the quality of life of COPD patients.*
Keywords: *chronic obstructive pulmonary disease, sleep, sleep quality, insomnia.*

Introduction

Patients with chronic obstructive pulmonary disease (COPD) frequently suffer from nocturnal alterations in ventilation and gas exchange, which are generally unrelated to the development of bronchospasm or to changes in airway resistance.[1] In patients with COPD, night time and early-morning symptoms are associated with an

increased rate of exacerbation, hospital admission and reduced survival[2] COPD patients are more likely to report regular use of hypnotic medications, difficulty falling or staying asleep, and daytime sleepiness. Nocturnal desaturation is associated with more sleep fragmentation and arousals most notably during REM sleep. The more severe the COPD and hypoxemia, the less total and REM sleep time. Other common co-existing medical problems such as gastroesophageal reflux can contribute to sleep disruption, and need to be considered.[3] Nocturnal hypoxemia and hypoventilation may occur in patients with severe COPD alone, but such changes are usually most pronounced when coexisting obesity and obstructive sleep apnea are present.[4] In such cases, which are often referred to as the overlap syndrome, the effects of obesity and OSA are usually predominant, and treatment that effectively eliminates OSA is often sufficient to reduce the consequences of daytime hypercapnia and right ventricular dysfunction.[5] The aim of the present study was to observe and describe the sleep pattern and quality in patients with varying severity of COPD.

METHODOLOGY

In this observational study we included all cases of known stable or newly diagnosed COPD on spirometry as per GOLD criteria with or without complaints of changes in sleep pattern or quality from January 1, 2018 till April 30, 2018. We included patients aged 35 years and above, with clinical diagnosis of COPD based on history and pulmonary function testing and consenting for the study. Patients with very severe COPD according to GOLD criteria, acute exacerbation, those with central nervous system lesions and taking psychiatric medications, those with recent history of myocardial infarction (< 3 months), arrhythmias or those with current or past history of pulmonary tuberculosis were excluded from the study. After approval of the institutional ethics committee, patients were approached to assess their eligibility. After explaining the purpose of the study, written consent was obtained from all patients.

Using a pre-tested semi-structured proforma, demographic, past medical history and clinical presentation of the patients were noted. Anthropometric measurements were noted for all patients to calculate their body mass index. Neck circumference was measured at the level of cricothyroid membrane and neck length was measured from occipital tubercle to the vertebra prominens. Polysomnography was performed using standard techniques and manually analysed according to the criteria of Rechtschaffen and Kales.[6] In the sleep laboratory, the patients were requested to sleep around 9 pm. The recording of sleep study was started after ensuring the impedance of electrodes was set to zero and assessment was done using parameters like electroencephalogram, electrocardiogram, electrocoulogram, electromyogram, nasal flow and thoracic wall movements. We objectively assessed the sleep quality in all study patients by obtaining sleep efficiency (time asleep/time in bed), sleep architecture and latency to persistent sleep. All patients breathed ambient oxygen throughout the night of study. Spirometry was done and assessed according to the American Thoracic Society/European Respiratory Society guidelines.[7] Staging of COPD was done according to the Global Initiative for Obstructive Lung Disease (GOLD) criteria.[8] All patient related data were expressed as means and standard deviations. Sleep quality was assessed according to sleep efficiency, sleep latency and mean duration of all four sleep stages, stratified by COPD GOLD staging. Statistical analysis was performed using SPSS version 17.

Results

During the study period a total of 168 patients were included. Of these 67% were males and mean age of the patients was 64.2 years. Of all the patients, 43% were smokers at the time of inclusion in the study. Anthropometric measurements of the patients revealed a mean

body mass index of 24.8 ± 4.2 kg/m^2, mean neck circumference of 35.4 ± 3.8 cm and mean neck length of 10.7 ± 1.6 cm. All patients underwent spirometery in which the mean absolute FEV^1 was 0.86 ± 0.38 litres and percentage predicted was 51.6%. Mean absolute FVC was found to be 2.34 ± 0.85 litres and FEV1/FVC ratio was 57.2 ± 11.4. In the present study, according to the GOLD staging 20% of the included patients had mild COPD, 45% had moderate COPD and 35% had severe COPD. PSG revealed that sleep efficiency, on an average in mild COPD was 82.7%, moderate COPD was 83.1 % and in severe COPD was 94.3%. Sleep latency was decreased in severe COPD patients (mean duration 4.76 minutes), normal in mild (mean duration 13.7 minutes) and moderate COPD (mean duration 16.5 minutes). As a percentage of total sleep time mean duration of Stage N1 in mild COPD was 12.9%, in moderate COPD was 20.1% and in severe COPD was 14.32%. Mean duration of Stage N2 in mild COPD was 30.2%, in moderate COPD was 32.1% and in severe COPD was 42.6 % of total sleep time. Mean duration of Stage N3 in mild COPD was 52%, in moderate COPD was 36.2% and in severe COPD was 25.5 % of total sleep time. Further, we observed that the mean duration of Stage R in mild COPD was 4.6 %, in moderate COPD was 3.7 % and in severe COPD was 5.9 % of total sleep time.

Table 1. Baseline characteristics of patients included in the study

Variable	N
Total number of patients	168
Age (in years)	64.2 ± 8.9
Males	114
Current smokers	73
Body mass index (kg/m^2)	24.8 ± 4.2
Neck circumference (cm)	35.4 ± 3.8
Neck length (cm)	10.7 ± 1.6
Absolute FEV_1 (L)	0.86 ± 0.38
FEV % predicted	51.6 ± 12.2
Absolute FVC (L)	2.34 ± 0.85
FEV_1/FVC ratio	57.2 ± 11.4
GOLD staging	
Mild	34
Moderate	75
Severe	59

FEV_1: Forced expiratory volume in the first second; FVC: forced vital capacity;
FEV_1/FVC : ratio of forced expiratory volume in the first second and forced vital capacity

Table 2 Quality of sleep of patients included in the study

	COPD staging		
	Mild (n=34)	Moderate (n=75)	Severe (n=59)
Sleep efficiency	82.7 ± 7.5	83.1 ± 6.4	94.3 ± 2.5
Sleep latency (minutes)	13.7 ± 8.44	16.5 ± 9.2	4.76 ± 3.4
Duration as percentage of total sleep time			
Stage N1	12.9 ± 1.23	20.1 ± 4.22	14.32 ± 2.93
Stage N2	30.2 ± 4.01	32.1 ± 3.68	42.6 ± 3.75
Stage N3	52.6 ± 2.91	36.2 ± 6.15	25.5 ± 3.51
Stage R	4.3 ± 1.8	3.7 ± 1.5	5.9 ± 1.1

Discussion

The present study describes the sleep quality in patients with COPD with or without complaints about sleep. The effects of COPD on sleep architecture are not well understood. Cormick et al reported a high prevalence of impaired sleep

quality and a high arousal index in patients with severe COPD, which was also associated with oxygen desaturations in patients.[9] The authors also observed that approximately one third of patients with stable COPD reported difficulty in falling asleep and more than two thirds reported frequent awakenings at night. Klink et al observed a high prevalence of patients with difficulty in maintaining sleep with a diagnosis of COPD compared to controls without airflow obstruction.[10] A report by Bellia et al conducted in patients with COPD or asthma similarly demonstrated a higher prevalence of early awakenings in patients compared with controls.[11] However, none of these studies performed polysomnography to rule out sleep apnea. It has been observed that nocturnal oxygen therapy to relieve hypoxemia did not alter the frequency or duration of arousals.[12] A study demonstrated an increased likelihood for obstructive sleep apnea related symptoms in patients with COPD. [13] This suggests screening of COPD patients for sleep disordered breathing. Furthermore study have indicated a high prevalence of self-reported snoring in patients with chronic bronchitis.[14]

Recently, several studies have reported clinical outcomes in COPD patients with sleep disturbances. In a study of patients with COPD, night time and early-morning symptoms were associated with poorer health status, impaired daily activities and increased risk of exacerbation than in patients without these symptoms.[15] McSharry et al performed a polysomnography assessment of patients with COPD and observed that sleep efficiency was low (66%) and REM sleep was diminished (12.7%) in comparison with historical populations.[16] Few authors have studied the effect of bronchodilators on sleep quality as well. Martin et al demonstrated a significant improvement in the effect sizes on total sleep time and REM sleep.[17] However, McNicholas et al were unable to demonstrate a change in TST and other parameters of sleep quality after the use of tiotropium.[18] Ryan et al also demonstrated an improvement in oxygen saturation following treatment with salmeterol, but there was no significant change in sleep quality.[19] Future studies are needed to investigate the role of supplemental oxygen and pharmacological agents like theophylline, acetazolamide and tiotropium in improving the sleep quality.

Conclusion

In conclusion, the present report that the quality and pattern of sleep are altered in COPD patients. Sleep efficiency which includes total sleep time was good in our patients, but sleep latency (time taken to fall asleep) was increased in patients with all grades of COPD obstruction. Thus the importance of good sleep hygiene and measures to improve sleep quality in COPD patients will help to improve the quality of life of COPD patients.

Study Funding: None
Conflict of interest: None

References

1. Casey KR, Cantillo KO, Brown LK. Sleep-related hypoventilation/hypoxemic syndromes. Chest 2007; 131:1936.
2. Calverley PM, Rennard SI, Clerisme-Beaty E, et al. Effect of tiotropium on night-time awakening and daily rescue medication use in patients with COPD. Respir Res 2016; 17: 27.
3. Calverley PM, Brezinova V, Douglas NJ, et al. The effect of oxygenation on sleep quality in chronic bronchitis and emphysema. Am Rev Respir Dis 1982; 126:206.
4. Brown LK. Sleep-related disorders and chronic obstructive pulmonary disease. Respir Care Clin N Am 1998; 4:493.
5. Chaouat A, Weitzenblum E, Krieger J, et al. Association of chronic obstructive pulmonary disease and sleep apnea syndrome. Am J Respir Crit Care Med 1995; 151:82.
6. Rechtschaffen A, Kales A. A Manual of Standardized Terminology, Techniques and Scoring System for Sleep Stages of

Human Subjects. US Government Printing Office, Public Health Service, Washington, 1968.
7. Miller MR, Hankinson J, Brusasco V et al. Standardisation of spirometry. Eur. Respir. J. 2005; 26: 319–38.
8. Pauwels RA, Buist AS, Calverley PMA, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. NHLBI/WHO Global Initiative for Chronic Obstructive Lung Disease (GOLD) Workshop Summary. Am J Respir Crit Care Med. 2001;163:1256–76
9. Cormick W, Olson LG, Hensley MJ, Saunders NA. Nocturnal hypoxaemia and quality of sleep in patients with chronic obstructive lung disease. Thorax 1986;41(11):846–54.
10. Klink M, Quan SF. Prevalence of reported sleep disturbances in a general adult population and their relationship to obstructive airways diseases. Chest 1987;91(4):540–6.
11. Bellia V, Catalano F, Scichilone N, Incalzi RA, Spatafora M, Vergani C, et al. Sleep disorders in the elderly with and without chronic airflow obstruction: the SARA study. Sleep 2003;26(3):318–23.
12. Fleetham J, West P, Mezon B, Conway W, Roth T, Kryger M. Sleep, arousals, and oxygen desaturation in chronic obstructive pulmonary disease. The effect of oxygen therapy. Am Rev Respir Dis 1982;126(3):429–33.
13. Karachaliou F, Kostikas K, Pastaka C, Bagiatis V, Gourgoulianis KI. Prevalence of sleep-related symptoms in a primary care population – their relation to asthma and COPD. Prim Care Respir J 2007;16(4):222–8.
14. Baik I, Kim J, Abbott RD, Joo S, Jung K, Lee S, et al. Association of snoring withchronic bronchitis. Arch Intern Med 2008;168(2):167–73.
15. Price D, Small M, Milligan G, et al. Impact of night-time symptoms in COPD: a real-world study in five European countries. Int J Chron Obstruct Pulmon Dis 2013; 8: 595–603.
16. McSharry DG, Ryan S, Calverley P, et al. Sleep quality in chronic obstructive pulmonary disease. Respirology 2012; 17: 1119–1124.
17. Martin RJ, Bartelson BL, Smith P, et al. Effect of ipratropium bromide treatment on oxygen saturation and sleep quality in COPD. Chest 1999; 115: 1338–1345.
18. McNicholas WT, Calverley PM, Lee A, et al. Long-acting inhaled anticholinergic therapy improves sleeping oxygen saturation in COPD. Eur Respir J 2004; 23: 825–831.
19. Ryan S, Doherty LS, Rock C, et al. Effects of salmeterol on sleeping oxygen saturation in chronic obstructive pulmonary disease. Respiration 2010; 79: 475–481.