ISSN2515-8260 Volume 09,Issue 01,2022

A study on sleep related breathing disorders among COPD patients

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Abstract
COPD is a growing global epidemic and it is estimated to kill around 3 million people every year. It is currently the 4th largest killer disease in the world and expected to climb to 3rd position by the year 2030. WHO has estimated that 600 million people worldwide have COPD. It affects around 5-10% of population over the age of 40 years but still there is wide variations in the prevalence between countries. Patients underwent Spirometric analysis and those with post bronchodilator FEV1 < 40% are asked for willingness to participate in the study. Those who are willing to participate are screened for inclusion into the study. Informed Consent was obtained from all the patients. GOLD criteria revealed that majority of the patients in our study i.e.27(45%) were of Grade 1 followed by 22(36.7%) were from Grade 2, 10(16.7%) from Grade 3 and 1(1.7%) were of Grade 4.
Keywords: Sleep related breathing disorders, COPD, GOLD criteria

Introduction

COPD isdefined as apreventableand treatable disease with pulmonary component characterised by airflow limitationthat is of not fully reversible which is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases and some significant extrapulmonary effects that may contribute to the severity in individual patients[1].

It was also defined in a joint statement of American Thoracic Society and the European Respiratory Society as a disease characterized by and diagnosed with spirometric measurement of airflow limitation that is not fully reversible which is also supported by GOLD[2].

COPD is a growing global epidemic and it is estimated to kill around 3 million people every year. It is currently the 4th largest killer disease in the world and expected to climb to 3rd position by the year 2030. WHO has estimated that 600 million people worldwide have COPD. It affects around 5-10% of population over the age of 40 years but still there is wide variations in the prevalence between countries[3].

The prevalence of insomnia symptoms, insomnia disorder, restless leg syndrome and hypoxemia is increased in COPD.Furthermore, polysomnographic(PSG) evaluation generally reveals decreased sleep efficiency and lower mean overnight oxygen saturation in COPD patients compared to controls.

In COPD, the pathogenesis of sleep disorders appears to be a complex and multifactorial process, likely consequent to one or more ofthefollowing:physiological changes associated with sleep, hypoxemia, hypercapnia, inflammation, COPD medications and/or nicotine use. Comorbid disorders as well as primary sleep disturbances may also contribute to disrupted sleep in COPD patients. For example, nocturnal gastroesophageal reflux (GERD) is

ISSN2515-8260 Volume 09,Issue 01,2022

associated with both symptoms of sleep apnea and COPD, and may contribute to thepathogenesis,andconcomitant occurrence of both disorders.GERD may also influence sleep quality which could potentially contribute to some of the sleep complaints reported by persons withCOPD.The following sections describe the diverse sleep disorders and sleep-related abnormalities encountered in patients with COPD[4].

Insomnia is defined as difficulty falling asleep, staying asleep, waking up too early,or having unrefreshing sleep. The prevalence of insomnia is increasedin patientswith COPD.One study found that DSM-IV insomnia wasreported in 32.9% ofthose with COPD, compared with only 20.3% of those without COPD. A history of COPD was associated with significantly increased odds of insomnia 1.9 (1.5-2.5) after adjusting for age and gender ($p < 0.001$). PSG did not revealasignificant overall difference in sleep latency or sleep efficiency in those withorwithoutCOPD. However, a higher proportion of persons with COPD had a low sleep efficiency (< 82%) than those without COPD (44% vs. 31%, $p = 0.04$).A recent study found a high prevalence of insomnia disorder (27.3%), defined as presence of insomnia symptoms along with daytime manifestations, in patients with COPD.Whether COPD severity is related to worse sleep is unclear. Some studies suggest worse sleep in more severe COPD,while other studies have not shown an association between FEV1 and reported sleep quality.Associated respiratory symptoms such as cough and sputum production appear to be better predictors of sleep disturbances.However, in one study, severity of dyspnea using the Medical Research Council dyspnea scale did not correlate with prevalence of insomnia.The authors hypothesized that nocturnal dyspnea may have a different etiology than diurnal dyspnea. While the latter may be related to exertion and inability to do tasks due to shortness of breath, several other factors, such as nocturnal hypoxemia and associated increased pulmonary vascular pressures, may contribute to nocturnal dyspnea[5, 6].

Methodology

Study population

Both male and female with COPD diagnosis presenting to the OPD or getting admitted in Medical College Hospital and Research Centre.

Study design: Longitudinal observational study.

Sample size: 60.

Sampling technique: Simple Random technique.

Inclusion criteria

- Known patients of COPD.
- Age >40 Years.
- Have an obstructive pattern on pulmonary function tests.
- Those who are willing to participate in the study.

Exclusion criteria

- Patients already receiving CPAP for sleep disorders.
- Patients receiving oxygen therapy.
- Age < 40years.

Variables used in study: Age, gender, COPD, sleep disorders.

Methods of data collection

Patients underwent Spirometric analysis and those with post bronchodilator FEV1 < 40% are asked for willingness to participate in the study. Those who are willing to participate are

ISSN2515-8260 Volume 09,Issue 01,2022

screened for inclusion into the study. Informed Consent was obtained from all the patients.
Detailed History, symptoms of nocturnal cough, wheeze, history of lifetime alcohol, smoking and clinical examination of patients done.
Height and weight were measured and BMI calculated, Neck circumference, Waist circumference measured. Respiratory Rate, Pulse rate, Blood pressure, Day time Oxygen saturation measured.
Patient was advised to avoid intake of caffeine on the day of study. He/She is refrained from having nap at daytime on the day of study.
Patient was asked to go to bed one hour before the usual sleep time, hooking up of the polysomnogram instrument was completed and the lights are off at the usual sleep time and the recording was started. Full attended polysomnography was performed with Medicaid systems, Sleep care SC 32 Polysomnogram.
Polysomnography was done and the following sleep variables according to American Academy of Sleep Medicine (AASM) criteria are recorded.

- Total Bed Time (TBT).
- Total Sleep Time (TST).
- Sleep efficiency.
- Sleep latency.
- Sleep stages in minutes and as percentage of TST.
- Arousal index.
- Respiratory event (apnoea and hypopneas) were measured in seconds.
- Apnoea-hypopnea index.
- Minimal nocturnal oxygen saturation.
- Mean nocturnal oxygen saturation.
- Patients with nocturnal desaturation are recorded.

Criteria for scoring based on American Academy of Sleep Medicine (AASM): Apnoea-Apnoea is scored when there is a drop in the peak signal excursion by ≥ 90% of pre-event baseline for ≥ 10 seconds The Apnoea is scored as Obstructive if the above criteria with continued or increased inspiratory effort throughout the entire period of absent airflow.
The Apnoea is scored as Central if the above criteria is met with absence of inspiratory effort The Apnoea is mixed apnoea if it begins as a central apnoea, but towards the end there is effort to breathe without airflow.

Hypopnea is diagnosed if all the following are present
The peak signal excursions drop by ≥30% of pre-event baseline using nasal pressure sensor.
The duration of the ≥30% drop in signal excursion is ≥10 seconds.
There is a ≥4% oxygen desaturation from pre-event baseline.
AHI (Apnoea Hypopnea Index) is the average number of apnoeas and hypopneas per hour of sleep.

Results

Table 1: Distribution according to type of SRBDs

			Percent
SRBDs	OSA	45	75.0
	Night awakening	9	15.0
	Insomnia	6	10.0
	Total	60	100.0

Prevalence of OSA in our study was 75%, night awakening was 15% and insomnia was 10%.

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Table 2: Distribution according to AHI (Apnoea hypo apnoea index)

		Frequency	Percent
AHI	Normal	16	26.7
	Abnormal	44	73.3
	Total	60	100.0

Apnoea hypo apnoea index was abnormal in 44 patients i.e. 73.3%.
So the prevalence of abnormal AHI in our study was 73.3%.

Table 3: Distribution according to ODI

		Frequency	Percent
ODI	Normal	18	30.0
	Abnormal	42	70.0
	Total	60	100.0

Apnoea oxygen desaturation index was abnormal in 44 patients i.e. 70%.
So, the prevalence of abnormal ODI in our study was 70%.

Table 4: Distribution according to GOLD criteria

		Frequency	Percent
Gold criteria	Grade 1	27	45.0
	Grade 2	22	36.7
	Grade 3	10	16.7
	Grade 4	1	1.7
	Total	60	100.0

GOLD criteria revealed that majority of the patients in our study i.e.27(45%) were of Grade 1 followed by 22(36.7%) were from Grade 2, 10(16.7%) from Grade 3 and 1(1.7%) were of Grade 4.

Discussion

Sleep quality is likely to be particularly important in the setting of a chronic, symptomatic, and progressive disease such as chronic obstructive pulmonary disease (COPD). COPD may lead to worse sleep quality and insomnia by virtue of respiratory symptoms, such as nocturnal cough and dyspnea. Moreover, poor sleep quality could contribute to poor COPD related outcomes such as exacerbations or even mortality risk. Such adverse effects could operate through various pathways. Poor sleep quality could lead to impaired cognition, thus impairing COPD self-management behaviours. Alternatively, poor sleep quality may impair immune function, contributing to the likelihood or severity of COPD exacerbations.

Poor sleep quality may act in ways that depend on the presence of underlying COPD, which underscores the need to study sleep disturbance specifically in COPD populations.

Prevalence of OSA in our study was 75%, night awakening was 15% and insomnia was 10%. Bouscoulet LT *et al.* [7] reported that the study included 4,533 subjects (1,062 in Mexico City, 941 in Montevideo, 1,173 in Santiago and 1,357 in Caracas). Snoring was reported by 60.2% (95% CI 58.8% to 61.6%), excessive daytime sleepiness by
16.4% (15.3% to 17.5%), observed apneas by 12.3% (11.4% to 13.3%), insomnia by
34.7% (33.3% to 36%), sedative use by 15.1% (14.1% to 16.2%), daytime napping by 29.2% (27.7% to 30.6%) and a combination of snoring, sleepinessand observed apneas by 3.4% (2.9% to 4%).

Previous studies have reported prevalences of snoring in adults that range from a low of 2% to a high of 85%, depending on the method of measurement used.

Excessive daytime sleepiness-a risk factor for traffic accidents-was reported by 7.5% of

participants, a result that concurs with Hara *et al*.[9]and Duran *et al*.[10]who reported similar prevalences of EDS in population-based studies. The factors that we found to be significantly associated with EDS were snoring, observed apneas, insomnia, and daytime napping. Men reported EDS as often as women; nonetheless, the primary sleep disorder causing EDS may well be different for the 2 genders, with insomnia being more frequent among women and snoring among men. In contrast to men, women showed no association between observed apneas and EDS.

Mean ODI before treatment in our study was 31.29±26 whereas it was 17.75±42.32 after treatment. The difference in the mean ODI before and after treatment was found to be statistically significant (<0.05). It means oxygen desaturation index is significantly reduced after treatment in our study.

Mean apnoea hypo apnoea index before treatment in our study was 30.17±27.57 whereas it was 12.29±13.79 after treatment. The difference in the mean ODI before and after treatment was found to be statistically significant (<0.001). It means apnoea hypo apnoea index (AHI) is significantly reduced after treatment in our study.

Yu K *et al*.[10] reported mean AHI before and after treatment was 40.75 ± 19.86 and 4.80 ± 1.72 respectively. Mean ODI before and after treatment was 33.53 ± 22.39 and 3.29 ± 2.13 respectively.

Conclusion

- Prevalence of OSA in our study was 75%, night awakening was 15% and insomnia was 10%.
- OSA is a morbid condition in which patients present with EDS. This uncontrolled and untimely sleep can cause serious automobile and occupational accidents. Moreover, excessive day time sleepiness and fatigue may hamper professional success also. Much other comorbidity can be arising in long term obstructive sleep apnea patients such as depression, decrease sexual desire and increase cardiovascular risk.

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