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Diagnostic Role of Global Sleep Assessment Questionnaire in Stable Chronic Obstructive Pulmonary Disease Patients

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ABSTRACT

Background: There is a complex interaction among COPD symptoms, sleep problems, ongoing medicines and other comorbidities in COPD patients so it is noteworthy whether the GSAQ may be used in COPD patients in the same way as in general population. We did a study on stable COPD patients with the aim to investigate the utility of GSAQ in stable COPD patients. We also investigated various sleep disorders in stable COPD patients and their relationship with patient's demographics, smoking status and diseases severity.

Methods: This prospective observational study was carried out on clinically stable COPD patients. A Hindi translation of GSAQ was self-administered by each patient. The sensitivity and specificity of GSAQ in COPD patients were calculated, using diseases defining criteria as the gold standard. The sleep disorders ware also compared to patient demographics, smoking status and diseases severity.

Results: The sensitivity and specificity of GSAQ in identifying insomnia, RLS, daytime sleepiness and anxiety-depression were 91/95%, 91.7/90%, 70.5/79.2% and 81.1/96.5% respectively. In this study the prevalence of sleep disorders was 56.4%. The commonest sleep problem was insomnia (35%) followed by RLS (31%), parasomnia (18%) and sleep apnoea (11.7%). These were no significant difference between GSAQ positive and negative group in patient's demographics, smoking status and diseases severity. The COPD patients with insomnia had significantly lower FEV_1 as compared to those without insomnia.

Conclusion: GSAQ may be used in COPD patients for both screenings and to rule out core intrinsic sleep disorders and depression- anxiety. Sleep disorders are frequent problems in stable COPD patients and insomnia is the most common among them.

Keywords: Global sleep assessment questionnaire, COPD, Sleep disorders

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INTRODUCTION

Global sleep assessment questionnaire (GSAQ) is quick and easy to apply sleep disorder screener for general population that covers four out of six core intrinsic sleep disorders namely, insomnia, restless leg syndrome (RLS), sleep apnea and parasomnia.[1] It is the most suitable screener in terms of comprehensiveness, brevity and overall quality appraisal for the general population.[2]

Since the quality of sleep is a major determinant of health related quality of life in chronic obstructive pulmonary diseases (COPD) patients, it has to be identified and managed at the earliest in order to improve the disease outcome.[3] The reason of poor quality of sleep in COPD patients may be because nocturnal symptoms, nocturnal desaturation, nicotine use, nicotine withdrawal, increase work of breathing, associated anxiety-depression,

gastroesophageal reflux diseases (GERD) or medications such as theophylline. There is a complex interaction among COPD symptoms, sleep problems and other comorbidities in COPD patients so it is noteworthy whether the GSAQ may be used in COPD patients in the same way as in general population.

The relationship between COPD severity (newer ABCD class, Gold severity and dyspnea severity) and occurrence of sleep disorder is also still not very clear. Some studies showed poor quality of sleep in more severe COPD, while another few studies have not found any relation between the severities of COPD and sleep disorders. In some studies symptoms such as cough and expectoration had been proved to be better predictors of sleep disorders.[4-8] We did a

study on stable COPD patients with the aim to investigate the utility of GSAQ in stable COPD patients. We also investigated various sleep disorders in stable COPD patients using GSAQ as the investigating tool and their relationship with patient's demographics, smoking status and diseases severity.

METHODS

Study design
This cross sectional observational study was carried out on clinically stable COPD patients who attended respiratory medicine outpatients unit of the institute. All previously diagnosed COPD patients who came for routine follow up during September 2019 to January 2020 were enrolled for the study after written and informed consent. The study was approved by institutional ethical committee. Exacerbation in last six weeks, drug or alcohol addiction and uncontrolled systemic illness were the exclusions. Total 94 patients who met the eligibility criteria within the study period and gave consent for the study were analysed.

Sociodemographic and clinical data
Sociodemographic data, including age, sex, Body mass index (BMI) and smoking status were recorded from detailed clinical history. Participants were also asked for their symptoms, current medications and any exacerbation leading to hospitalization in last one year. The COPD assessment test (CAT) score was recorded for each patient in view of classifying these patients, according to newer ABCD classification.[9]

Assessment of COPD
Severity of dyspnea was recorded using modified medical research council (mMRC) scale.[10] Spirometry was done by trained technicians as per American thoracic society guidelines for diagnosis as well as to grade the severity of COPD.[11] The diagnostic criteria of COPD was post bronchodilator $FEV_1/FVC<0.7$ and failure to increase in FEV_1 >200 ml and 12% after 400 µg salbutamol. The severity of COPD was categorized on the basis of post bronchodilator forced expiratory volume in first second (FEV_1) as per global initiative for COPD (GOLD) criteria, i.e., stage I (FEV_1% ≥ 80), stage II (50%≤ FEV_1% <80), stage III (30≤ FEV_1% <49) and stage IV (FEV_1% <30). The refined ABCD assessment tool was also applied and patients were classified into A, B, C and D groups as per GOLD guidelines.[12]

Assessment of sleep disorders
A self-answered Hindi translation of GSAQ was recorded from each participant. GSAQ is 11 items questionnaire that focuses on insomnia, sleep apnea, RLS, parasomnia and depression-anxiety. The response to each question is noted as never, sometimes, usually or always. The GSAQ was labelled as positive, if response of one or more of these items was sometimes, usually or always.[1]

Only those patients who responded positively to item five and six were the subject for polysomnography. A separate epworth sleepiness scale (ESS) was also applied on each patient and recorded[13]. Insomnia, RLS, and depression were further inquired in all patients. Defining criteria for insomnia and RLS were as per the International Classification of Sleep Disorders (ICSD-3) and revised IRLSSG-2012 diagnostic criteria respectively [14,15]. Depression-anxiety was assessed using the PHQ-4 questionnaire, which is ultra-brief four item sensitive screener. It is a 12-point scoring system ranging from 0 to 3

for each question. Scores are rated as normal (0–2), mild (3–5), moderate (6–8), and severe (9–12).[16]

Statistical analysis
Patients were classified into two groups GSAQ positive and GSAQ negative. Individual disorders were also analysed further. Comparison of categorical variables was performed using the chi square test. Continuous data were presented as mean and standard deviation and compared using student t test. The "p" value was calculated after application of tests of significance. The results were considered statistically significant at level P <0.05.

RESULTS

Total 94 patients who fulfilled the eligibility criteria were analysed. In this study the majority (86) of participants were male. The mean age of patients was 62.3 (range 40-86) years. The baseline features of the study patients are given in table 1. In this study 53 (56.4%) patients reported with at least one sleep related problem. The commonest sleep problem was insomnia (35%) followed by RLS (31%), parasomnia (18%) and sleep apnoea (11.7%).

The sensitivity and specificity of GSAQ in identifying insomnia and RLS were 91/95% and 91.7/90% respectively. As there is no standard test for identifying parasomnia, all patients who responded positively to item nine were considered as confirmed case of parasomnia. Eleven patients who gave positive response for item five and/or six were subjected for polysomnography and out of these only seven patients were identified as having OSA. The sensitivity and specificity of GSAQ in identifying daytime sleepiness and anxiety-depression were 70.5/79.2% and 81.1/96.5% when compared with epworth sleepiness scale and PHQ-4 for daytime sleepiness and anxiety-depression respectively (table 2).

We could not find any significant difference between GSAQ positive and negative group in patient's demographics, smoking status, dyspnea severity, FEV_1, GOLD severity and newer ABCD class. In GSAQ positive group the mean FEV_1 was lower as compared to GSAQ negative group however this difference was not statistically significant (Table 3). When we compared individual disorder for any difference we found significantly lower FEV_1 in patients who had insomnia as compared to those without insomnia (1.21±0.49 L v/s 1.43±0.51 L, P=0.02). We also found significantly higher BMI in patients who complained of sleep apnoea symptoms as compared to those without sleep apnea complaints (21.84±5.21 Kg/m^2 v/s 18.96± 4.69 Kg/m^2, p=0.045).

DISCUSSION

We have various questionnaires for sleep disorder screening. These questionnaires are either directed to a single sleep disorder or if screen multiple disorders, they are very lengthy and time consuming. GSAQ is there to screen four core intrinsic sleep problems along with daytime sleepiness and anxiety-depression disorder with a quality of comprehensiveness and brevity. It is considered as the best possible sleep disorder screener available for the general population with good sensitivity, specificity and test-retest reliability.[1] The sleep problems in COPD may be either related to the symptoms of COPD itself or as a separate comorbidity so the accuracy of GSAQ should be tested separately in COPD patients. The utility of GSAQ as a sleep disorder screener in COPD patients is still not clearly

established. To be best of our knowledge there is only one study in which author used the GSAQ in COPD patients and investigated sensitivity and specificity for insomnia, RLS and depression.[17] In our study we not only investigated the accuracy of GSAQ for identifying sleep disorders but also for daytime sleepiness and anxiety depression also. In this study we found more than 90% sensitivity and specificity of GSAQ in identifying various parameters in stable COPD patients that is satisfactory.

Table 1: Characteristics of study population (original)

S.N	Parameter		N (% or range)
1	Age		62.3 (40-86) Years
2	Gender		86 (91.48)
			8 (8.52)
3	BMI		19.29 (11.42-31.5) Kg/m²
4	Smoking status	Current	36 (38.29)
		Former	43 (45.74)
		Never	15 (15.95)
5	mMRC dyspnea severity	1	20 (21.27)
		2	43 (45.74)
		3	28 (29.78)
		4	3 (3.19)
6	Newer ABCD Class	A	16 (17.02)
		B	30 (31.91)
		C	6 (6.38)
		D	42 (44.68)
7	FEV₁ (absolute)		1.35 (0.4-3.02) L
8	Gold severity	1	29 (30.85)
		2	37 (39.36)
		3	22 (23.4)
		4	6 (6.38)
9	GSAQ	Positive	55 (58.5)
		Negative	39 (41.5)
10	Insomnia	As per GSAQ	33 (35.1)
		As per ICSD-3	33 (35.1)
11	RLS	As per GSAQ	29 (30.85)
		As per IRLSSG	24 (25.53)
12	Sleep apnea		11 (11.7)
13	Parasomnia		17 (18.08)
14	Depression-anxiety	As per GSAQ	32 (34.04)
		As per PHQ-4	37 (39.36)
15.	Daytime sleepiness	As per GSAQ	29 (30.85%)
		As per ESS	17 (18.1%)

Table 2: Comparison of GSAQ with standard questionnaire (original)

		GSAQ	Standard questionnaire
Insomnia	Positive	33	33
	Negative	61	61
RLS	Positive	29	24
	Negative	65	70
Daytime sleepiness	Positive	29	17
	Negative	65	77
Anxiety-depression	Positive	32	37
	Negative	62	57

Table 3: Comparison between GSAQ positive and negative group (original)

S.N.	Parameter		GSAQ positive N=55 (58.5%)	GSAQ negative N=39 (41.5%)	P value
1	Sex	Male	50	36	0.81
		Female	5	3	
2	Age		61.5±9.82	63.43±9.73	0.34
3	BMI		19.91±4.66	18.42±4.14	0.11
4	Smoking status	Current	21	15	0.76
		Former	24	19	
		Never	10	5	
5	mMRC grade dyspnea	1	9	11	0.3
		2	24	19	
		3	20	8	
		4	2	1	
6	COPD group	A	7	9	0.17
		B	17	13	
		C	2	4	
		D	29	13	
7	FEV₁	% predicted	67.72	72.41	0.47
		Absolute	1.296±0.50	1.43±0.48	0.17
8	GOLD stage	1	14	15	0.31
		2	24	13	
		3	12	10	
		4	5	1	

Insomnia, depression and RLS have huge impacts on COPD patient's life. While insomnia results in reduced quality of life, increased daytime sleepiness, increased atherosclerosis risk, neuropsychiatric deficit, hypertension and diabetes depression reduces treatment adherence and increases exacerbation risk.[18-20] RLS further impairs quality of life by decreasing sleep efficiency; increased sleep latency and arousal index.[21] For the comprehensive management of COPD patients, it is essential to identify and treat sleep disorder in order to improve their quality of life and to prevent several other adverse outcomes. Identifying depression-anxiety in COPD patients and developing appropriate treatment plans also have the potential to improve quality of life and to reduce health care utilization.[19,20,22]

GSAQ may become useful tool in identifying sleep disorders as well as depression anxiety in COPD patients with good sensitivity and specificity. It is quick and easy to apply tool that can be used at primary care centres and also at busy scheduled outpatient care centres with less time consumption. Dissemination of this tool to the primary centres where the routine care of COPD is done may be helpful in identifying sleep disorders at the earliest in order to improve the quality of life and overall outcome in COPD patients. Since our study indicates sensitivity and specificity of GSAQ near around 90% and 95%, respectively, it can be used for both screening and ruling out core intrinsic sleep disorders, daytime sleepiness and anxiety-depression.

We investigated the prevalence of sleep disorders in stable COPD patients and it was found to be within the ranges (34-78%) of various previous studies.[5,7,8,17,23-26] However, none of these studies investigated sleep disorders in such structured format with GSAQ as in ours. Sameer Vaidya et al first studied GSAQ in stable COPD patients and found 55% patients with any sleep disorders in their study.[17] The

prevalence of individual sleep disorder in our study was within the ranges of previous studies.

The reported prevalence of insomnia among COPD patients varies from 27-53% as compared to 10% in the general population.[4,5,27,28] The established causes of insomnia in COPD are nocturnal symptoms, nocturnal hypoxia, nicotine use and withdrawal, increased sympathetic tone, medications like theophylline, comorbid conditions like anxiety-depression, GERD and other sleep disorders like sleep disordered breathing and RLS. There is a complex interaction among insomnia, depression and RLS. While depression is well known cause of insomnia, RLS patients are more prone to develop depression, anxiety and panic disorders due to poor sleep quality.[29,30] This interaction was also reflected in our study as we observed 11 patients with insomnia, depression and RLS all together (three disorders in one patient) and 18 patients with insomnia and depression (two disorders in one patient). COPD patients are more likely to develop depression-anxiety as compared to healthy population and the depression score further increases with severity of COPD.[19] In fact, COPD and depression-anxiety have bidirectional relationship. While depression-anxiety increases risk of COPD exacerbation and possibly death, COPD increases the risk of developing depression.[20]

The prevalence of depression-anxiety, RLS and parasomnia in our study was also in the ranges of previous studies.[17,22,26,31] In our study, 11 participants complained of sleep apnoea symptoms, however the diagnosis of OSA was confirmed only in seven patients by polysomnography, the gold standard test for OSA.

In our study, we found some different observations from previous studies. First, we could not find any significant relationship between FEV_1 and occurrence of any sleep disorder while previous study by Sameer Vaidya et al reported significantly lower FEV_1 in GSAQ positive group [17]. Second, our findings on insomnia were different from previous study by Budhiraja et al who reported higher prevalence of insomnia among current smokers and no relationship between insomnia and FEV_1.[5] In our study, we found significantly lower FEV_1 among patients with insomnia and no relationship between patient's smoking status and insomnia. Third, we could not found any relationship between RLS and severity of airway obstruction while previous study by Yuksel Kaplan et al had reported more severe obstruction in COPD patients with RLS as compared to those without RLS.[26] These differences may reflect variations in criteria of stable COPD, sample size and methodology. The criteria for stable COPD in the study by Sameer Vaidya et al was no exacerbation in last one month, in study by Budhiraja et al it was no exacerbation in last three months while yuksel Kaplan et al did not defined the criteria of stable COPD. In our study we used the criteria of stable COPD as no exacerbation in last six weeks that seems to be more logical. Our study has several limitations firstly frequency of occurrence of multiple sleep disorders in a patients and related contribution was not studied in detail. Furthermore, other sleep disorders like nocturnal desaturation, sleep hypoventilation and circadian sleep disorders were not studied in our study.

CONCLUSION

GSAQ may be used in stable COPD patients for the purpose of multiple sleep disorders screening with good accuracy. Sleep disorders are frequent complaints among COPD

patients and insomnia is the most common among them. A regular inquiry about sleep in COPD patients, followed by management if required, may have potential to improve their quality of life and reduce health care utilization. COPD patients with insomnia had significantly lower values of FEV_1 as compare to COPD patients without insomnia.

Key Message
Global sleep assessment questionnaire may be used in COPD patients for both screenings and to rule out core intrinsic sleep disorders and depression- anxiety. Sleep disorders are frequent problems in stable COPD patients and insomnia is the commonest among them.

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