Research Article

Obstructive sleep apnea: an experience

Syed Suriya Arajmand Farooq[1], Nazia Mehfooz[1], Manzoor Ahmad Malik[2], Naveed Nazir[1], Khurshid Dar[1], Suhail Amin Patigaroo[2]

[1]Department of TB and Chest Diseases, Government Medical College, Srinagar, Jammu and Kashmir, India.
[2]Department of ENT, HNS Government Medical College, Srinagar, Jammu and Kashmir, India.
Correspondence to: Nazia Mehfooz, E-mail: Dr_suhail_jnmc@yahoo.co.in

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Abstract

Background: Obstructive sleep apnea (OSA) is a common disorder of repetitive pharyngeal collapse during sleep. It is more common among middle-aged adults. Obesity leads to and intensifies OSA. Epidemiologic studies have recorded relations of OSA with hypertension. The Berlin Questionnaire may find persons at high possibility for OSA and hence can evade costly polysomnography (PSG) studies, especially in resource-limited settings. This study is about our experience of Berlin Questionnaire and clinical characteristics of patients with OSA.

Objective: To reveal our experience of OSA in terms of (i) age/sex distribution; (ii) Berlin Questionnaire utility; (iii) clinical features; (iv) polysomnograhic findings; and (v) association with obesity and hypertension.

Materials and Methods: This prospective observational study was done in the Department of Chest Medicine and Department of ENT, Head and Neck Surgery of Government Medical College, Srinagar, Jammu and Kashmir. Outpatient department/inpatient department patients who showed positive scoring on Berlin Questionnaire were enrolled in the study. PSG was done in all of these patients. Clinical features, blood pressure, and body mass index (BMI) were noted in patients who showed positive PSG.

Result: This study included a total of 120 Berlin Questionnaire positive patients, of which 96 were positive on PSG. Positive predictability value of Berlin Questionnaire was 80% for both low- and high-risk cases. Majority of PSG positive cases were female subjects (68.75%) while males comprised 31.25% of PSG positive cases. Most common age group was 51–65 years. Of PSG positive OSA patients, 41 (42.7%) showed mild disease, 30 (31.2%) moderate disease, and 25 (26%) severe disease. Most patients were grouped as per BMI into obese class II, and majorities were subjects with hypertension. In addition to snoring, other clinical features were dry mouth, excessive daytime sleepiness, and irritability.

Conclusion: Berlin Questionnaire is an important screening tool to detect suspected OSA patients. Although male subjects are more commonly seen to be affected in literature, we found female predominance. Most of these patients are middle-aged. Obesity is an important risk factor, and most of these patients show BMI > 30 kg/m^2. Most of these patients present hypertension as a comorbidity.

KEY WORDS: OSA, polysomnography, Berlin Questionnaire, obesity, hypertension

Introduction

The International Classification of Sleep Disorders, second edition (The ICSD-2) subdivides sleep disorders into eight major categories, one of which is sleep-disordered breathing (SDB). SDB is further classified into three basic categories: central sleep apnea (CSA) syndromes, obstructive sleep apnea (OSA) syndromes, and sleep-related hypoventilation/hypoxic syndromes.[1] OSA is the most common type, constituting greater than 85% of all cases of SBD; CSA is far less common.[2]

OSA is a common disorder of repetitive pharyngeal collapse during sleep. Pharyngeal collapse can be incomplete (causing hypopnea) or complete (causing apnea). In most apneic events, the brain arouses for a short while in order for the body to carry on breathing which subsequently leads to fragmented and poor quality sleep.

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Sleep apnea affects people of all ages, but occurrence data put forward that it is more usual among middle-aged adults aged between 40 and 60 years.[3] Higher prevalence of OSA is seen in men than women, and it is estimated to have a male to female ratio of between 3:1 and 5:1.[4]

Epidemiologic studies have recorded relations of OSA with hypertension. Data suggest that approximately 40% of patients with sleep apnea exhibit hypertension, whereas 30% of hypertensive patients exhibit occult sleep apnea.[5]

Epidemiological studies show that body weight, and in particular BMI, is the strongest risk factor for OSA. It is estimated that about 70% of those with OSA are obese and that the prevalence of OSA in obese men and women is about 40%.[2] About 26% of patients with a BMI greater than 30 kg/m^2 and 33% of those with a BMI greater than 40 kg/m^2 present moderate OSA.[2]

Clinical symptoms can include snoring, excessive daytime sleepiness (EDS), daytime fatigue, feeling tired despite a full night's sleep, morning headaches, personality and mood changes, dry or sore throat, gastroesophageal reflux, and sexual dysfunction.[2]

OSA is diagnosed on the basis of clinical symptoms, risk factors, and a formal sleep study [polysomnography (PSG), or a portable home-based test]. There are several obstructive sleep apnea syndrome (OSAS) questionnaires available as screening tools to identify patients at risk for OSAS. However, it is important to remember that these questionnaires are screening tools only and cannot replace a thorough history and physical or objective sleep laboratory (PSG).

The Epworth sleepiness scale (ESS) has been universally adopted as an effective screening method to monitor for clinical symptoms of sleep apnea. Other effective screening tools that have been used in the primary care population are the Berlin Questionnaire (BQ), STOP-BANG questionnaire,[2] Sleep Apnea of Sleep Disorder Questionnaire (SA-SDQ)[6] and Apnea Risk Evaluation System (ARES).[7]

The BQ was first introduced in 1996 at the Conference on Sleep in Primary Care in Berlin, Germany. This questionnaire includes three categories: snoring, wake-time sleepiness or tiredness, and the presence of obesity or hypertension. The BQ has been utilized in the diagnosis for OSA and is known to be a comfortable and cheap tool. A systematic review has shown that the BQ has a higher sensitivity and specificity (as high as 97%) in predicting OSA.[8] The BQ may identify individuals at high risk for OSA, and thus can avoid expensive PSG studies, especially in resource-limited settings.

The gold standard for the diagnosis of OSAS is attended overnight PSG. The Apnea–Hypopnea Index (AHI) is an index used to assess the severity of sleep apnea based on the total number of apneas and hypopneas occurring per hour of sleep.[2]

In this observational study, we present our experience of OSA patients in terms of their clinical characteristics and polysomnographic outcomes, with special emphasis on BQ.

Materials and Methods

This prospective observational study was done in the Department of Tuberculosis and Chest disease and Department of ENT and HNS for a period of 1 year from December 2014 to December 2015. A total of 120 patients who were at risk of showing OSA based on BQ (Appendix) were selected in outpatient department/inpatient department of two departments.

All patients with category one positive and undiagnosed fresh cases were included in the study.

Patients in whom category one was negative; patients already diagnosed with OSA; patients using continuous positive airway pressure; persons aged younger than 18 years; and patients with chronic kidney disease, heart failure, and neurological disease were excluded from the study.

All these patients were subjected to the full-night PSG. The diagnosis of OSA was confirmed following the criteria proposed by the adult OSA Task Force of the American Academy of Sleep Medicine. Patients were categorized into groups on PSG based on AHI as mild with AHI: 5–14.9, moderate: 15–30, and severe: >30.

Detailed clinical data including the symptoms and physical examination were done only in PSG positive patients.

The anthropometric data including gender, age, weight, and BMI were noted. EDS was assessed by an ESS score of >10.

The WHO (2004) grading was used to grade people on the basis of BMI (kg/m^2) as normal with BMI 18.50–24.99, preobese: 25.00–29.99, obese class I: 30.00–34.99, Obese class II: 35.00–39.99, Obese class III: > or = 40.

Presence or absence of hypertension was noted, and patients were labeled as hypertensive subjects on the basis of JNC 8 criteria.

Data were analyzed and formulated.

Result

A total of 120 patients were positive on BQ. Of them, 10 were in low risk, and 110 were found in high-risk category. PSG was done in all these cases.

OSA on PSG was seen in 96 of 120 patients. Eight of ten cases in low-risk group were positive on PSG, while of 110 high-risk cases, 88 were positive on PSG. The percentage of patients positive on PSG (positive predictive value of BQ) in both groups was 80%. Six of eight PSG positive cases in low-risk category showed moderate disease, while most of the high-risk patients showed mild disease. Overall, of 96 PSG positive OSA patients, 41 (42.7%) showed mild disease, 30 (31.2%) moderate disease, and 25 (26%) severe disease [Table 1].

Total number of male subjects in the study was 37, while female subjects 83. Of 37 male subjects, only 30 were PSG positive, while of 83 female subjects, only 66 were PSG positive. Percentage of BQ positive male and female cases who were subsequently positive on PSG were 81% and 79.5%, respectively [Table 2].

Most of the patients in BQ positive [54 (45%)] and PSG positive [45 (46.8%)] were seen in age group 51–65 years, while lowest number were seen in age group 20–35 years. Majority of male (50%) and female subjects (75%) with OSA were seen in the age group 51–65 years [Table 3].

In addition to snoring which was seen in 100% of OSA patients, the majority of the OSA patients revealed other symptoms; Sixty-six patients (68.7%) complained of dry mouth especially in the morning, 62 (64.5%) of patients complained of daytime sleepiness, 30 (31.2%) complained of gasping/choking at night, and 26 (27.0) of morning headaches. The least common accompanying symptom was irritability seen in 17 (17.7%) of patients [Table 4].

About 80.2% of OSA patients were obese with BMI > 30 kg/m^2. Of 96 patients, majority (40) were in obese class II, followed by 21 in obese class I, 16 in obese class III (morbid obese), 14 preobese while 5 patients showed normal BMI [Table 5].

Of 96 OSA patients, 79 (82.2%) were hypertensive subjects, while 17 (17.7%) were normotensive subjects. Most of the OSA with hypertension patients (40 of 45 OSA patients) were seen in the 51–65 years age group [Table 6].

Table 1: Berlin Questionnaire and PSG correlation

Category	No. of patients	No. of OSA	Normal	Degree of OSA			% of patients positive on PSG
				Mild	Moderate	Severe	
Low risk							
Category 1 Positive	10	8	2	1	6	1	80
High risk							
Category 1 positive in all	110	88	22	40	24	24	80

Table 2: Sex distribution and degree of OSA on PSG

Sex/no. of patients	No. of OSA	No. of normal patients	Degree of OSA		
			Mild	Moderate	Severe
M-37	30	7	10	13	7
F-83	66	17	33	15	18

Table 3: Distribution of BQ positive and PSG positive patients in different age groups

Age group (years)	No. of patients in BQ	No. of OSA on PSG	Males in OSA	Females in OSA
20–35	7	3	2	1
36–50	48	40	10	30
51–65	54	45	15	30
66–80	11	8	3	5

Table 4: Symptomatology of PSG positive patients (total: 96)

Symptom	No of patients	Percentage of total PSG positive
Snoring	96	100
Dry mouth	66	68.7
Excessive daytime sleepiness	62	64.5
Gasping/choking	30	31.2
Morning headaches	26	27.0
Nocturia	20	20.8
Memory loss	18	18.7
Irritability	17	17.7

Table 5: Distribution of PSG positive patients according to the WHO grading for BMI

BMI (kg/m²)	BQ positive	No of OSA on PSG	Normal patients on PSG	Degree of OSA		
				Mild	Moderate	Severe
18–24.9 (Normal)	7	5	2	1	3	1
25–29.9 (Preobese)	15	14	1	8	3	3
30–34.9 (Obese class 1)	28	21	7	9	7	5
35–39.9 (Obese class II)	50	40	10	17	12	11
>or = 40 (Obese class III)	20	16	4	7	3	6

Table 6: Hypertension in different age group of patients with OSA

Age group (years)	No. of patients	No. of OSA on PSG	No. of hypertensive subjects in OSA	Normotensive subjects in OSA
20–35	7	3	2	1
36–50	48	40	30	10
51–65	54	45	40	5
66–80	11	8	7	1

Discussion

OSA is the most common sleep-disordered breathing. PSG centers have long waiting lists and in view of that, a special interest in screening tools for OSA has developed. While each of these has its own strengths and limitations, they all basically focus on similar high-risk features, such as habitual snoring, witnessed apneas, a high BMI, male sex, and advanced age.

BQ is one of them and is useful in screening sleep apnea in a primary-care population. Using BQ as a screening tool for sleep apnea in primary-care population seems acceptable, being more convenient and less costly for health-care users.

This study included 120 snorers who were positive on BQ. Majority of patients (91.6%) fell into high-risk category. OSA on PSG was seen in 96 (80%) of 120 patients with 41 (42.7%) presenting mild disease, 30 (31.2%) moderate disease, and 25 (26%) severe disease. So, the positive predictability value of BQ was 80% in our study. Percentage of BQ positive male and female cases who were subsequently positive on PSG were 81% and 79.5%, respectively. Similar results were reported in a study by Bouloukaki et al.[9] on 129 BQ positive patients, of which 118 were PSG positive (91.5%). Somewhat low percentage of PSG positive patients were seen in a study by Thurtell et al.[10] on 30 BQ positive idiopathic intracranial hypertension patients, where 18 (60%) patients showed OSA on PSG, with 7 (23.3%) presenting mild, 4 (13.3%) moderate, and 7 (23.3%) severe OSA.

We found percentage of patients positive on PSG in both high- and low-risk groups (PPV) to be 80%, while Thurtell et al.[9] and Bouloukak et al.[10] found 75% and 93.7% in high-risk and 30% and 84.8% in low-risk groups, respectively.

We found most of the high-risk patients with mild disease, while most of low-risk patients with moderate disease. In a study by Bouloukaki et al.,[9] AHI scores were higher in the group identified as being at high risk of having sleep apnea by the BQ.

Because we only took BQ positive patients and not all suspected ones, we could not calculate the sensitivity and specificity of BQ, but on the contrary many studies have been done, such as in a study by Netzer et al.,[10] the sensitivity and specificity obtained were 54% and 97%, respectively. BQ showed a moderate to high sensitivity (76%–84%), a specificity that was low to moderate (40%–61%) in a study by Bouloukaki et al.[9] A study by Sharma et al.[11] reported that the BQ had a sensitivity of 86%, specificity of 95%, and positive and negative predictive values of 96% and 82%, respectively.

It is clear from ours and others observations that, if BQ is positive there is a high likelihood that a person would actually have sleep apnea.

The incidence of OSA among male and female subjects is 3:1 before menopause. However, the incidence of OSA is equal among males and female subjects following menopause.[12] There are many reasons for this male predominance. Men tend to gain weight more centrally than do women, and this pattern probably results in men having more fat stored in upper airway structures and the abdomen than do women. Several studies suggest that the airway is longer in men than in women, independent of body height, which could explain the increased propensity for airway collapse in men. The passive pharyngeal airway collapsing pressure is generally higher in men than in women for any given BMI.[13] Women also have better respiratory load responses than do men and the more central fat distribution in men might reduce lung volumes for a given BMI.[13] In contrary to what is established from epidemiological studies, we found female subjects predominate in our study. Of 96 PSG positive patients 30 (31.2%) were male and 66 (68.7%) were female subjects. The possible explanation for female predominance is that male subjects are dominant in our society, and female subjects are bit submissive. With the results, wives do not dare to tell their husband to seek medical attention for snoring, while male subjects get their wives immediate consultation done in case they snore.

Age is another major risk factor. Older individuals might have reduced tethering of the upper airway by lung volume because of loss of elastic recoil in the lung. They might also have a more easily collapsible airway caused by loss of collagen or a reduced arousal threshold caused by poorer quality of sleep. Finally, the efficiency of the upper airway dilator muscles might fall with age.[13] In our study, majority of male subjects (50%) with OSA were seen in the age group of 51–65 years, while majority of female subjects (45.4%) were seen each in the age groups of 36–50 and 51–65 years. The lowest male (6.6%) and female subjects (1.6%) were seen in the age group 20–35 years. This is in accordance with a study done by Shao et al.[14] on 415 OSA patients, where 390 (93.9%) were young and middle-aged, and 25 (6.1%) were elderly persons. Bixler et al.[15] found that OSA prevalence increases with age. Spanish researchers also found a direct relationship between increasing age and the prevalence of OSA.[16] The prevalence is estimated to triple in individuals older than 65 years of age compared with individuals aged 30–64 years.[2]

In addition to snoring which was seen in 100% of our OSA patients, the majority of the OSA patients showed other symptoms; about 68.7% complained of dry mouth especially in the morning, 64.5% of patients complained of daytime sleepiness, 31.2% complained of gasping/choking at night, 27.0% complained of morning headaches. The least common accompanying symptom was irritability seen in 17.7% of patients. OSA is known to cause significant sleep disturbances, leading to EDS and fatigue which could potentially result in vehicular and industrial accidents. It may lead to a gradual decline in cognitive ability and poor performance.[3] Data obtained from a chart audit of 4 million enrollees of the Veterans Health Administration have shown that psychiatric comorbid diagnoses including depression, anxiety, posttraumatic stress disorder, psychosis, and bipolar disorders are associated with OSA.[3] OSA is also associated with several cardiorespiratory problems.[3]

We found 80.2% of our patients were obese. Of 96 patients, majority (40) were in obese class II [BMI (kg/m^2): 35.00–39.99], followed by 21 in obese class I [BMI (kg/m^2): 30.00–34.99] and 16 in obese class III (morbid obese) [BMI (kg/m^2) > or = 40], while 5 patients showed normal BMI.

Epidemiological studies have consistently shown that body weight, and in particular BMI, is the strongest risk factor for OSA.[2] It is estimated that 60%–90% of patients with sleep apnea are obese (defined as BMI > 28 kg/m^2), and that a BMI of 28 kg/m^2 has a sensitivity of 93% and a specificity of 74% for sleep apnea.[3] It is possible that obesity may worsen OSA because of fat deposition at specific sites. Fat deposition in the tissues surrounding the upper airway appears to result in a smaller lumen and increased collapsibility of the upper airway, predisposing to apnea. Moreover, fat deposits around the thorax (truncal obesity) reduce chest compliance and functional residual capacity and may increase oxygen demand. Visceral obesity is common in subjects with OSA.[17]

Of our 96 OSA patients, 79 (82.2%) were hypertensive subjects, while 17 (17.7%) were normotensive subjects. Reports indicate that as many as 50% of patients with hypertension show concomitant OSA.[18] Data from study done by Yu et al.[18] show that 21.0% (26.3% of female and 20.5% of male subjects) of the patients with OSA exhibited concurrent hypertension.

Observational studies show that OSA is an independent risk factor for systemic hypertension, beyond the effects of obesity, sex, and age.[18] There is an abundance of evidence implicating OSA as an important secondary cause of hypertension. Possible mechanisms for the association between OSA and hypertension in obese individuals include increased sympathetic activity, sleep disturbance, elevated angiotensin level, oxidative stress, systemic inflammation, endothelial dysfunction, renal dysfunction, and increased arterial stiffness.[8] Three large cross-sectional studies were reported at the end of the last century. The Wisconsin Sleep Cohort study showed that sleep-disordered breathing was associated with an increased prevalence of hypertension in employed middle-aged adults.[19] The National Institutes of Health-funded Sleep Heart Health Study reported an odds ratio of 1.37 of developing hypertension using a multivariable analysis comparing the highest category of AHI ≥ 30/h with the lowest category (< 1.5/h).[20] Another cross-sectional study, reported from the sleep clinic of St. Michael's Hospital in Canada, showed that an increase in the AHI by one event/h was associated with a 1% risk of showing hypertension.[21]

Overall, cross-sectional studies show clear associations between OSA severity and hypertension in adults, but the data in children are less clear. However, not all longitudinal studies in adults support a causal relationship.[22]

Conclusion

Our study confirms the importance of BQs in OSAS screening. This tool is inexpensive and easy to apply and should be used as a screening test in clinical practice. With this tool, clinicians can identify high-risk groups of patients who can then be referred for confirmatory PSG. Mild disease was more common in our group. Male subjects are more commonly seen to be showing OSA, but our study found female subjects to be commoner probably owing to our conservative culture. OSA was seen more common in the middle age to elderly persons. Obesity is a well-established risk factor, and hypertension is a common comorbidity. Most of our patients were hypertensive subjects and showed BMI greater than 30. Apart from snoring, our patients complained of dry mouth, excessive sleepiness, nocturia, and irritability.

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APPENDIX

Berlin Questionnaire

Sleep apnea

Height (m) _____ Weight (kg) _____ Age _____ Male/Female

Please choose the correct response to each question.

CATEGORY 1	CATEGORY 2	CATEGORY 3
1. Do you snore? □ a. Yes □ b. No □ c. Don't know *If you answered "yes":*	6. How often do you feel tired or fatigued after your sleep? □ a. Almost every day □ b. 3–4 times per week □ c. 1–2 times per week □ d. 1–2 times per month □ e. Rarely or never	10. a. Do you have high blood pressure? □ Yes □ No □ Don't know b. BMI of the patient:
2. You snoring is: □ a. Slightly louder than breathing □ b. As loud as talking □ c. Louder than talking □ d. very loud can be heard in adjacent rooms	7. During your waking time, do you feel tired, fatigued or not up to par? □ a. Almost every day □ b. 3–4 times per week □ c. 1–2 times per week □ d. 1–2 times per month □ e. Rarely or never	
3. How often do you snore? □ a. Almost every day □ b. 3–4 times per week □ c. 1–2 times per week □ d. 1–2 times per month □ e. Rarely or never	8. Have you ever nodded off or fallen asleep while driving a vehicle? □ a. Yes □ b. No *If you answered "yes":*	
4. Has your snoring ever bothered other people? □ a. Yes □ b. No □ c. Don't know	9. How often does this occur? □ a. Almost every day □ b. 3–4 times per week □ c. 1–2 times per week □ d. 1–2 times per month □ e. Rarely or never	
5. Has anyone noticed that you stop breathing during your sleep? □ a. Almost every day □ b. 3–4 times per week □ c. 1–2 times per week □ d. 1–2 times per month □ e. Rarely or never		

Scoring Berlin Questionnaire

The questionnaire consists of three categories related to the risk of having sleep apnea. Patients can be classified into high risk or low risk based on their responses to the individual items and their overall scores in the symptom categories.

Categories and Scoring:

Category 1: items 1, 2, 3, 4, and 5.

Item 1: if "**Yes**," assign **1 point.**

Item 2: if "**c**" or "**d**" is the response, assign **1 point.**

Item 3: if "**a**" or "**b**" is the response, assign **1 point.**

Item 4: if "**a**" is the response, assign **1 point.**

Item 5: if "**a**" or "**b**" is the response, assign **2 points.**

Add points. Category 1 is positive if the total score is 2 or more points.

Category 2: items 6, 7, and 8 (item 9 should be noted separately).

Item 6: if "**a**" or "**b**" is the response, assign **1 point.**

Item 7: if "**a**" or "**b**" is the response, assign **1 point.**

Item 8: if "**a**" is the response, assign **1 point.**

Add points. Category 2 is positive if the total score is 2 or more points.

Category 3 is positive if the answer to item 10 is "**Yes**" or if the BMI of the patient

is greater than 30 kg/m^2.

High risk: if there are two or more categories where the score is positive.

Low risk: if there is only one or no category where the score is positive.