Prevalence of Symptoms and Risk of Sleep Apnea in the northern Population of Pakistan

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Abstract

Background: Sleep apnea is a chronic condition characterized by frequent episodes of upper airway collapse during sleep causing episodes of apnea and hypo-apnea. These episodes of apnea and hypo-apnea can cause repetitive hypoxia and awaken one from sleep. Increasingly, obstructive sleep apnea is also being recognized as an independent risk factor for several clinical consequences, including systemic hypertension, cardiovascular disease, stroke, and abnormal glucose metabolism.

Objective: To identify the prevalence and risk factors of sleep apnea in Chitral, Pakistan.

Method: A cross sectional study was conducted at the THQ hospital Booni, Chitral. The survey was conducted on individuals who had come to the hospital as attendants, patients or visitors of the admitted patients. We used the Berlin questionnaire to identify individuals at risk for OSA. The Urdu version of the Berlin questionnaire was embedded in our survey questionnaire. Written consent was obtained. Data was collected and analyzed using SPSS.

Results: 52 of a total 408 were at high-risk for OSAS according to the Berlin scale Questionnaire. Hence, the prevalence estimates of individuals at high-risk for OSAS was 12.75%. These participants were more likely to have conditions such as previous coronary artery disease, high cholesterol, and hypertension.

Conclusion: There is a high prevalence of OSA in Chitral and it is also associated with obesity, coronary diseases, smoking, and hypertension which is why it is important to have a proper evaluation and early screening for it. Given the high prevalence and association of OSA with many diseases, it is also important to increase awareness among physicians and the general population of rural areas, about the clinical presentations, risk factors and complications of OSAS.

Key words: sleep apnea; prevalence; moking; coronary disease

Introduction

Defined as upper airway collapse during sleep, Obstructive sleep apnea (OSA) is the most common sleep-related breathing disorder worldwide,which causes intermittent apneas or hypo-apneas in breathing. These episodes of apnea and hypo-apnea can cause repetitive hypoxia and awaken one from sleep (1). OSA status can be determined by the frequency of apnea and hypopnea events per hour by polysomnography and it is defined as an apnea-hypopnea index (AHI) of at least five events per hour (2).

These repeated episodes of complete or partial cessation of breathing can cause multiple adverse effects. It is associated with stroke, the second leading cause of death worldwide and the leading cause of long-term disability(3,4). Apnea and hypopnea in OSA can cause temporary elevations in blood pressure due to blood oxygen desaturation, arousal, and sympathetic activation and may cause elevated blood pressure during the daytime and, ultimately, sustained hypertension(5). It has been found to be an independent risk factor for hypertension and associated with drug-resistant hypertension and treatment of OSA with continuous positive airway pressure (CPAP) has resulted in better control of hypertension.(6,7). It has also been associated with insulin resistance and dyslipidemia.(8,9). OSA can cause excessive daytime sleepiness and impairment in the ability to sustain attention to tasks and decreased alertness, all of which have been associated with an increased risk of motor vehicle accidents (10). Epidemiological studies have consistently demonstrated the link between OSA and quality of life(11), cognitive impairment(12), and depression(13,14). These studies indicated a two-fold increase in depression in participants with mild OSA and two-to-six-fold increase with moderate to severe OSA.

OSA remains a significant public health problem in both developed and developing countries. According to early population-based epidemiological studies, the prevalence of OSA was 3% to 7% in men and 2% to 5% in women in the Western Caucasian population (15). Similar proportions have been noted in Asian countries, with a prevalence of 4.1 to 7.5% in men and 2.1 to 3.2% in women (16). South Asians, including India, Pakistan, Bangladesh, Sri Lanka, and Nepal, make up a quarter of the world's population and South Asians were found at an elevated risk for OSA compared to their Caucasian counterparts (17).

In South Asia countries, the majority of the population lives in rural villages and the prevalence of OSA may remain substantial but underappreciated due to the lack of resources like polysomnography. Studies in developed countries such as in the United States show 75% to 80% of OSA cases that could benefit from treatment remained undiagnosed(18,19). Diagnosis of OSA with polysomnography remains a challenge for studies in developing countries and particularly in rural settings. Berlin questionnaire is one of the screening instruments to identify subjects at risk of OSA with high sensitivity and negative predictive value and it has been validated in the South Asian population (20). In Pakistan, very few population-based data were available on the prevalence of OSA. We conducted the current study to identify the prevalence of OSA, and to determine its predictors in the villages of Chitral, Pakistan.

Material and Methods

Study population:
Chitral is a mountainous area in the extreme north of Pakistan. It is divided into small valleys by the mighty Hindu Kush ranges. Chitral Valley is at an elevation of 1128 meters. It is surrounded by Afghanistan, Dir, Gilgit, and Swat Kohistan. Villagers of Chitral are subsistence farmers and the inaccessibility of the area has been a strong impediment to development and health care. Diet of the mountain population consists of whole grain, fresh fruit, fresh vegetables, goat's milk, cheese, grape wine, with little intake of animal proteins. This study was conducted at the THQ hospital Booni, Chitral. The survey was conducted on individuals who had come to the hospital as attendants, patients or visitors of the admitted patients.

Inclusion criteria
All healthy individuals, above 18 years of age, who were visiting clinics, accompanying a patient or who were visiting a relative admitted in the hospital, were included. Study objectives were explained and verbal consent was obtained prior to inclusion in the survey.

Exclusion criteria
The following individuals were excluded from the sample
- Any individual not willing to participate in the survey.
- All persons associated with health care including doctors and nursing staff.
- Any individual below the age of 18.

Sample size and questionnaire
We required a sample size of 400 subjects to fulfill the objectives of our study at a 95% confidence level. After rounding-off the required sample, we conducted the Berlin questionnaire on a total of four hundred and twenty individuals. Twelve individuals did not answer one or more questions or dismissed the interview before completion. A total of 408 completed the interview (questionnaire) and were included in the final analysis

Hospital staff members included trained nurses and lady health care workers, accompanied by trained medical students collected the data by interviewing the subjects. Research staff used standard instruments (SECA, Germany) to measure weight and height. Weight was measured to the nearest 0.1 kg with the subject standing motionless on SECA electronic weighing machine without shoes. Height was measured to the nearest 0.1 cm using SECA portable Stadiometer with the subject standing erect against the vertical surface of Stadiometer without shoes. Staff members also took at least two measurements, each of weight, height, waist and hip circumference.

We used the Berlin questionnaire, a validated instrument in the South Asian population (20), to identify individuals at risk for OSA. The Urdu version of the Berlin questionnaire was embedded in our survey questionnaire. This questionnaire includes questions about snoring, witnessed apneas, self-reported hypertension, and obesity. This questionnaire was found to predict an AHI >5 with a sensitivity of 86 percent, the specificity of 95 percent, and positive and negative predictive values of 96 and 82 percent respectively in the South Asian population(20). 1

Data entry and statistical analysis

Data were double entered and statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics including frequencies, means ± standard deviations (SD) were calculated. Based on the responses of the participants to the Berlin questionnaire they were grouped into either high or low risk for OSAS.

Section 1:

Positive score for risk was defined as an answer in the agreement either of the following questions: snoring with intensity "louder than talking" or very loud, snoring frequency > 3–4 times a week, snoring enough to bother other people or witnessed apneas during sleep > 3–4 times per week.

Section 2:

The positive score was defined as a patient having a frequency of symptoms >3–4 times per week for two or more questions about drowsy driving or/and waking time sleepiness.

In the original Berlin questionnaire in Section II respondents are asked how often they feel tired or fatigued after sleep, and whether they ever fall asleep driving a car. We included questions such as a history of sleepiness while waiting for an appointment with the doctor, while watching television at home or while in a queue, instead of sleepiness while driving a car, as few people have had a car in these mountain villages. This modification was done in the Indian validation study (20).

Section 3:

We used measured weight and height to calculate Body Mass Index (BMI) and categorized according to the WHO cut-off for South Asian population, less than 18.5 kg/m2 for underweight, 18.5-23 kg/m2 for normal, 23-27.5 kg/m2 for overweight and 27.5 kg/m2 or higher for obesity(21).

Individuals were considered high risk for OSAS if they scored positive in two or more categories. Those who did not have symptoms or scored positive in less than two categories were placed in the low-risk group.

In the Berlin questionnaire, a section is considered positive if there are two affirmative answers in either section I or II or one affirmative response in section III. Individuals who have positive scores in two of the three sections are considered to be at risk for OSA.

In addition, the subjects were asked to report if they have been diagnosed by any health care worker with any of the following conditions: hypertension, or coronary artery diseases. Also, subjects were asked about their smoking status (smoker, ex-smoker, no smoking). Similarly, hip and waist of patients were measured to calculate their central obesity.

Results

Our study population consisted of individuals above 18 and mean age of 42.98 (+-15.03) years and BMI of 22.3. 23.3% were males and 76.7% were females. 52 of the total 408 were at high-risk for OSAS according to Berlin scale Questionnaire. Hence, the prevalence estimate of individuals at high-risk for OSAS was 12.75% as shown in Table 1.

52 of the total 408 participants were at high risk for OSA. These participants were more likely to have conditions such as previous coronary artery disease, high cholesterol, and hypertension (Table 2). In addition, they were more likely to have higher BMI, central obesity, low education, be smokers or ex-smokers, alcohol user and pipe/hookah user. However, subjects considered high risk were comparable with those considered low risk with regards to their sex and marital status (Table 2).

Discussion

This study is among the earliest surveys for investigating OSA in Pakistan, using the internationally validated Berlin Scale Questionnaire. We found the prevalence of high risk of having OSA to be 12.75%. Almost similar prevalence was reported in a study conducted in Karachi, Pakistan, which showed a prevalence of 10% high risk of having OSA (22). Another study separately reports the prevalence of symptoms suggestive of OSA without showing the relationship of them with the risk for OSA. (23)

Only a few studies have looked into the prevalence of OSA in the Asian population especially in the rural community. It is also difficult to compare studies because of the different methods for estimating the prevalence of OSA. A study done in the rural population of south India using the Berlin scale showed an overall prevalence of 8.72% (24). A similar study done in the rural population of Odisha, India reported a prevalence of 25% (25). The study was community-based. Out of the 223 households visited, 200 community dwellers were surveyed using the BQ, and 25% (50/200) had a high likelihood of OSA (25). An Iranian study using BQ found the prevalence of OSA to be 27.3% (26). Studies in China, however, report a lower prevalence of Sleep Disordered Breathing (3.7%) and OSAS (2.1%). The methodology employed in this study was different from our Berlin Questionnaire-based study. We used the Berlin questionnaire which was found to predict an AHI >5 with sensitivity of 86 percent, specificity of 95 percent, positive and negative predictive values of 96 and 82 respectively in the South Asian population (20). It is, therefore, reasonable to compare results with these regional studies.

Table 1

	Total		High-risk group		Low-risk group	
	n=408		n=52		n=356	
	n	%	n	%	n	%
1. Do you snore?						
◻ a. Yes	67	16.4	45	86.5385	22	6.17978
◻ b. No	341	83.6	7	13.4615	334	93.8202
◻ c. Don't know	0	0	0	0	0	0
2. Your snoring is:						
◻ a. Slightly louder than breathing	12	17.9	8	15.3	4	1.12
◻ b. As loud as talking	20	29.9	11	21.15	9	2.528
◻ c. Louder than talking	31	46.3	22	42.3	9	2.52
◻ d.very loud. Can be heard in adjacent rooms	4	6	4	7.69	0	0
3. How often do you snore?						
◻ a. Almost every day	13	19.4	7	13.4 6	6	1.68 8
◻ b. 3-4 times per week	22	32.8	20	38.4	2	0.5
◻ c. 1-2 times per week	25	37.3	12	23	13	3.6
◻ d. 1-2 times per month	7	10.4	6	11.5	1	0.28
◻ e. Rarely or never	0	0	0	0	0	0
4. Has your snoring ever bothered other people?						
◻ a. Yes	26	38.8	19	36.5	7	1.9
◻ b. No	22	32.8	14	26.9	8	2.2
◻ c. Don't know	19	28.4	12	23.07	7	1.96
5. Has anyone noticed that you stop breathing during your sleep?						
◻ a. Almost every day	1	1.5	1	1.92	0	0
◻ b. 3-4 times per week	8	11.9	8	15.3	0	0
◻ c. 1-2 times per week	9	13.4	7	13.46	2	0.561
◻ d. 1-2 times per month	12	17.9	7	13.46	5	1.4
◻ ◻ e. Rarely or never	37	55.2	22	42.3	15	4.2
6. How often do you feel tired or fatigued after your sleep?						
◻ a. Almost every day	60	14.7	13	25	47	13.2
◻ b. 3-4 times per week	15	3.7	10	19.23	5	1.4
◻ c. 1-2 times per week	24	5.9	2	3.84	22	6.17
◻ d. 1-2 times per month	49	12	2	3.84	47	13.2
◻ e. Rarely or never	260	63.7	25	48.07	235	66.01
7. During your waking time, do you feel tired, fatigued or not up to par?						
◻ a. Almost every day	83	20.3	17	32.69	66	18.5
◻ b. 3-4 times per week	15	3.7	3	5.769	12	3.37
◻ c. 1-2 times per week	49	12	12	23	37	10.3
◻ d. 1-2 times per month	74	18.1	0	0	74	20.78
◻ e. Rarely or never	187	45.8	20	38.4	167	46.91

(Table 1 continued)

8. Have you ever nodded off or fallen asleep while driving a vehicle?						
◻ a. Yes	55	13.5	9	17.3	46	12.9
◻ b. No	353	86.5	43	82.6	310	87
For the following question q9, all percentages are from the 55 people who said yes to the previous question rather than the total sample size						
9. How often does this occur?						
◻ a. Almost every day	16	29.1	7	13.4	9	2.5
◻ b. 3-4 times per week	8	14.5	1	1.92	7	1.96
◻ c. 1-2 times per week	17	30.9	1	1.92	16	4.49
◻ d. 1-2 times per month	1	1.8	0	0	1	0.28
◻ e. Rarely or never	13	23.6	0	0	13	3.651
10. Do you have high blood pressure?						
◻ Yes	95	23.3	38	73.0769	57	16.0112
◻ No	301	73.8	12	23.0769	289	81.1798
◻ Don't know	12	2.9	2	3.84615	10	2.80899
11. BMI						
underweight (<=18.5)	86	21.08	2	3.84615	84	23.5955
normal (18.5-23)	181	44.36	8	15.3846	173	48.5955
overweight (23-27.5)	82	20.1	13	25	69	19.382
Obese (>= 27.5)	59	14.46	35	67.3077	24	6.74157

Table 2

Risk factors	High risk	Low risk	
Coronary Artery Disease	73.1	10.7	<0.001
Diabetes	0	0.3	0.691
High blood cholesterol	73.5	17.6	<0.001
HTN	73.1	16	<0.001
Body mass index, (kg/m2)± (STD)	28.9 (6.6)	21.2 (4.0)	<0.001
Waist, cm, mean ± (STD)	97.63 (9.46)	81.55 (10.01)	<0.001
Hip, cm, mean ± (STD)	106.44 (7.79)	95.59 (8.62)	<0.001
Cigarettes/cigars/biddies history	21.2	5.9	<0.001
Drinking history	28.8	4.7	<0.001
Naswar history	28.8	13.6	0.005
Pipe/hookah history	7.7	0	<0.001
Waist-to-hip ratio, mean ± (STD)			
Central obesity [(≥0.90 cm (M); ≥0.85 cm (F)], %	0.92	0.85	<0.001
(based on waist to hip ratio)			
No	7.7	55.2	
Yes	92.3	44.8	<0.001
Height, cm, mean ± (STD)	160.25 (11.06)	162.99 (8.93)	<0.001
Weight, kg, mean ± (STD)	75.46 (12.37)	56.12 (10.52)	<0.001

However, in contrast to our study, western studies report much higher prevalence of OSA e.g. studies done in the United States using the Berlin questionnaire reported a 26% prevalence estimate of High Risk for OSAS [27].

The possible explanation for the difference in prevalence is perhaps that western populations have a higher prevalence of obesity and higher mean BMI [28]. Another possible explanation for the difference has been attributed to cephalometric differences (different mandibular lengths and the anteroposterior dimensions of the nasopharynx-pharyngeal tubercle to posterior nasal spine) (29).

We reported 16.4% prevalence of snoring in our population, which is almost similar to that reported in other studies of the Indian and Pakistani populations (22) (25). However, studies in the United States report 52% prevalence of snoring symptoms [27] which is much higher and this difference can once again be attributed to the differences mentioned before.

Excessive daytime sleepiness and morning fatigue are good indicators of OSAS (27). In our study the symptoms were significantly more prevalent among the high-risk group. A higher prevalence of fatigue and sleepiness can depend on working hours and total hours of sleep. It may prove helpful to record the total sleeping hours of an individual and the working hours along with the Berlin questionnaire in further studies.

In the original Berlin questionnaire in section II, respondents are asked how often they feel tired or fatigued after sleep, and whether they ever fall asleep driving a car. We included questions such as a history of sleepiness while waiting for an appointment with the doctor or while watching television at home or while in a queue instead of sleepiness while driving a car as a few people have cars in these mountain villages. This modification was also done in the Indian validation study (20). Almost eleven percent of our total study population reported positively. Our reported rate is similar to that reported in prior studies [22,27,30). This is an important public health hazard and needs attention as it puts many drivers at a greater risk for road traffic accidents(31).

Low level of education is an associated factor in the high-risk group for OSA in our study with a p-value of 0.001; a similar association has been reported in previous studies(26).

Knowing that our study consisted of a sample of middle-aged individuals (mean age 42.98 years) suggests that

the symptoms are more prevalent in middle-aged and older individuals. These results are consistent with other reported studies (26,24).

In our study we found that Central Obesity was identified as risk factor for OSA. As indicated in Table 2, 92.3% of people with Central Obesity reported OSA. Central Obesity was measured by waist to hip ratio as indicated in Table 4. This finding correlates to a similar cross-sectional study done on OSA at Aga Khan University Hospital in Karachi(22). Our findings also correlate with findings in studies done in rural India\ (24,25). 1

People with Coronary Artery Disease, hypertension and high blood cholesterol were identified as a high-risk group. In our study, about 73.1% ,73.1 % and 73.5% of people with Coronary Artery Diseases, hypertension and high cholesterol respectively, were found to be at high risk of OSA. Similar studies were done in our neighbouring countries e.g India and Iran (26) which also classified CAD, hypertension and high blood cholesterol as one of the high risk factors for OSA (22, 24,25), in addition smoking and alcohol use were also found to be directly associated with the incidence of OSA.

Limitations

• The results are based only on data from a single hospital that is not representative of the whole rural population of Pakistan. Secondly, we used convenience sampling, and so it is not possible to generalize results to the entire rural population of Pakistan.
• The use of the structured and validated Berlin questionnaire in our study strengthens the reliability of our results but the Berlin questionnaire has not been particularly validated for the Pakistani population.
• We also did not use any validated questionnaire to define comorbidity of the subjects, instead subjects were asked to report if they have been diagnosed by any health care workers.
• We also did not exclude participants with specific medical conditions, such as hypothyroidism, asthma, acromegaly, heart disease, renal disease, pregnancy, hormonal replacement therapy, etc, which may further limit the strength of our study.
• We were unable to assess facial abnormalities which we know are important factors in OSA related symptoms.
• It may prove helpful to record the total sleeping hours of an individual and the working hours along with the Berlin questionnaire in further studies.

Conclusion

This study on the rural community of Chitral, Pakistan estimates the prevalence of OSA to be 14.2%. Also, OSA is associated with obesity, coronary diseases, smoking, and hypertension which is why it is important to have a proper evaluation and early screening for it. Unfortunately, sleep medicine in Pakistan is in its very early stage and efforts are needed at the national and regional levels to address this problem. Given the high prevalence and association of OSA with many diseases, it is also important to increase awareness among physicians and the general population of rural areas, about the clinical presentations, risk factors and complications of OSAS.

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