Comparison of Stop Bang Questionnaire and Epworth Sleepiness Scale for Screening of Obstructive Sleep Apnoea

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ABSTRACT

BACKGROUND
Obstructive Sleep Apnoea (OSA) is the most common sleep-related breathing disorder and is associated with significant morbidity. A simple but accurate tool to screen patients for OSA is needed. We wanted to compare STOP-BANG Questionnaire & Epworth Sleepiness Scale to predict the probability of OSA.

METHODS
A prospective observational study of 46 eligible patients was undertaken. They were assessed using SBQ & ESS & stratified as per the risk of OSA. The Apnoea Hypopnea Index (AHI) was calculated & patients were stratified into mild, moderate & severe OSA. The SBQ scores, ESS scores & AHI was then studied along with the predictive probabilities of both questionnaires in diagnosing OSA.

RESULTS
Of the 46 patients, 89.13 % & 45.65 % were classified as high risk on the SBQ & ESS respectively. 78.26 % were diagnosed OSA on the sleep study according to AHI. SBQ had a high sensitivity to predict OSA (97.22 %) & low specificity (40 %). ESS had low sensitivity & high specificity to predict OSA being 52.78 % & 80 % respectively.

CONCLUSIONS
Both Stop-Bang questionnaire & ESS help in determining the risk of OSA. STOP-BANG is a better screening parameter due to its high sensitivity & negative predictive value.

KEY WORDS
Stop Bang, Epworth Sleepiness Scale, Obstructive Sleep Apnoea

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BACKGROUND

Obstructive Sleep Apnoea (OSA) is a sleep disorder which is characterized by the complete collapse or partial collapse of upper airways during sleep, resulting in cessations of breathing or reduction in airflow in the presence of respiratory effort.[1] This is characterized by arousals, sleep fragmentation, intermittent hypoxia, and hypercapnia including excessive daytime sleepiness, growth failure, school failure, behavioural problems, automobile accidents, or even sudden death.[2] Prevalence of OSA in India is ranging from 7.5-13.5 %.[3–5] Risk factors of sleep apnoea include obesity, gender, age, menopause, familial factors, craniofacial abnormalities, and alcohol.[2] Polysomnography (PSG) is considered as the gold-standard method for diagnosis of sleep apnoea and assessment of sleep apnoea. PSG is a non-invasive procedure that includes over-night continuous monitoring of numerous physiological variables including electro-encephalography, eye-movements, muscle-tone as well as respirator- effort, airflow, and oxygen saturation. [6] OSA is detected when the apnoea–hypopnoea index (AHI), i.e. the total number of obstructive apnoea and hypopnoea per hour of sleep is > 5. The severity of OSA is graded according to commonly used clinical criteria as mild (AHI ≥ 5 but <15), moderate (AHI ≥ 15 but < 30), or severe (AHI ≥ 30).[7] In view of high-cost and in-accessibility of PSG, several screening questionnaires have been developed. The most popular questionnaires are Berlin questionnaire (BQ), STOP-BANG, and Epworth Sleepiness Scale (ESS). These questionnaires had extensive range of sensitivity and specificity in different races.[8–12] The current study aimed at comparing the sensitivity, specificity, positive predictive value, negative predictive value and likelihood ratio of STOP-BANG questionnaire and Epworth Sleepiness Scale in diagnosis of OSA.

METHODS

This study was conducted in the Department of Respiratory Medicine, SRM Medical College Hospital & Research Centre, among outpatients and inpatients suspected to have obstructive sleep apnoea. According to Franklin et al[13] study, considering the prevalence of obstructive sleep apnoea (OSA) defined at an apnoea-hypopnea index (AHI) ≥ 5 as 9 % with a precision of 10 % and 95 % confidence interval, the sample size is calculated using the formula N = Z21-α / 2 * p * (1 - p) / d2 the sample size calculated was 31. It was a prospective Observational study where 46 patients with clinical suspicion of OSA (Obesity, Excessive Day time Sleepiness, Snoring, Resistant Hypertension, and Unexplained Pulmonary Hypertension) were included. The inclusion criteria include patients of age between 20-60 years with clinical suspicion of OSA and who were willing for PSG. All those with coexisting chronic respiratory illness, advanced heart failure, coronary artery disease malignancies, psychiatric disorder, diagnosed case of central sleep apnoea, pregnancy, sleep disorders other than sleep disordered breathing, patients on treatment with Continuous positive airway pressure (CPAP) were excluded from the study. All the patients included in the study were assessed using detailed clinical history including family history and a thorough physical examination including anthropometric measures like body weight, height, body mass index (BMI), and neck circumference (NC). Screening of OSA was done by STOP-BANG Questionnaire[14] and ESS[15]. Apnoea-hypopnea index (AHI) was calculated for diagnostic accuracy of STOP-BANG and ESS. The STOP-BANG questionnaire includes four subjective (STOP: snoring, tiredness, observed apnoea, and high blood pressure) and four demographics items (Bang: body mass index [BMI], age, neck circumference, gender). Answering yes to three or more items is categorized as high risk for OSA. STOP-BANG questionnaire was validated in meta-analysis for screening of OSA in sleep clinic and surgical patients.[9,13,14] The ESS is an eight-item questionnaire to measure daytime sleepiness. Questionnaire has a four-point Likert response format (0–3), which they rate based on their chances of falling asleep or dozing off while engaged in an eight different types of activities and the score ranges from 0 to 24. ESS score ≥ 11 indicates excessive daytime sleepiness and high risk for OSA.[8,15]

Statistical Analysis

Descriptive statistics were presented as minimum, maximum, and mean ± standard deviation (SD). Each questionnaire was compared on the following parameters: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), the likelihood ratio for a positive result (LR+), and the likelihood ratio for a negative test result (LR−) using SPSS version 16.

RESULTS

The mean age of study population was 49.43 ± 12.15 years. Minimum age was 21 years and maximum were 70 years in the study population. Among the study population 27 (58.70 %) participants were males and remaining 19 (41.30 %) participants were females. The mean height was 1.57 ± 0.16 meters. Minimum height was 1.20 and maximum was 1.76 in the study population. The mean weight was 85.54 ± 19.63 kg. Minimum weight was 51 kg and maximum were 119 kg. The mean BMI was 34.46 ± 5.79. Minimum level was 22 and maximum was 46 in the study population. The mean neck circumference was 39.91 ± 2.89. Minimum level was 34 and maximum was 44 in the study population. Among the study population all 46 (100 %) participants had snoring habit, 12 (26.09 %) participants had day time tiredness, only 6 (13.04 %) participants had observer apnoeic spells. Among the study population 32 (69.57 %) participants had hypertension.

	STOP-BANG	ESS
High Risk (> = 3)	41 (89.13 %)	21(45.65 %)
Low risk (< 3)	5 (10.87 %)	25(54.35 %0

Table 1. Distribution of Stop-Bang Questionnaire Score and ESS in the Study Population (n = 46)

Among the study population 41 (89.13 %) participants had high stop bang (> = 3) and 5 (10.87 %) participants had low risk (< 3) and 21 (45.65 %) participants had high ESS (> = 11) and remaining 25 (54.35 %) participants had low ESS (< 11). (Table 1)

The mean AHI was 25.02 ± 22.42. Minimum level was 0 and maximum level was 88 in the study population. Among the

study population 10 (21.74%) had normal AHI, 10 (21.74 %) had mild AHI, 11 (23.91 %) had moderate AHI and remaining 15 (32.61 %) had severe AHI. Among the study population 36 (78.26 %) were positive with AHI OSA and 10 (21.74 %) were negative with AHI OSA.

Variables		AHI OSA (+ Ve) (N = 36)	AHI OSA (-Ve) (N=10)	Chi Square	P Value
STOP-BANG	High Risk (> =3)	35 (97.22 %)	6 (60 %)	11.192	<0.001
	Low Risk (< 3)	1 (2.78 %)	4 (40 %)		
ESS	High Risk (> = 11)	19 (52.78 %)	2 (20 %)	3.389	0.066
	Low Risk (< 11)	17 (47.22 %)	8 (80 %)		

Table 2. Comparison of AHI with Stop - Bang and ESS

Among the people with positive AHI 35 (97.22 %) had high stop bang, only one subject had low stop bang. Among the people with negative AHI 6 (60 %) had high stop bang, 4 (40 %) had low stop bang. The difference in the proportion of stop bang between AHI was statistically significant. (P value < 0.001). Among the people with positive AHI 19 (52.78 %) had high ESS, 17 (47.22 %) had low ESS. Among the people with negative AHI 2 (20 %) had high ESS, 8 (80 %) had low ESS. The difference in the proportion of ESS between positive and negative AHI was statistically not significant. (P value 0.066). (Table 2)

Parameter	STOP-BANG	ESS
Sensitivity	97.22 %	52.78 %
Specificity	40.00 %	80.00 %
False positive rate	60.00 %	20.00 %
False negative rate	2.78 %	47.22 %
Positive predictive value	85.37 %	90.48 %
Negative predictive value	80.00 %	32.00 %
Diagnostic accuracy	84.78 %	58.70 %

Table 3. Predictive Validity of Stop - Bang in Predicting AHI (N=46)

High and low stop bang had sensitivity of 97.22 %in predicting AHI, Specificity was 40.00 % (95 CI 12.16 % to 73.76 %), False positive rate was 60.00 %, False negative rate was 2.78 %, Positive predictive value was 85.37 %, Negative predictive value was 80.00 % and the total diagnostic accuracy was 84.78 %. (Table 3)

High and low ESS had sensitivity of 52.78 % in predicting AHI, Specificity was 80.00 %, False positive rate was 20.00 %, False negative rate was 47.22 % (95 CI 30.41 % to 64.51 %), Positive predictive value was 90.48 %, Negative predictive value was 32.00 % and the total diagnostic accuracy was 58.70 %. (Table 3)

DISCUSSION

The most common sleep related breathing disorder is the obstructive sleep apnoea. Snoring, daytime sleepiness, fatigue and apnoea are the characteristics of obstructive sleep apnoea. The complications associated with obstructive sleep apnoea are the cardiovascular disorders, cognitive impairment, epilepsy, fatigue, sleepiness and diabetes.[16,17] The present study was conducted to determine the diagnostic accuracy of Stop-Bang questionnaire and ESS used to screen obstructive sleep apnoea.

Among the study population, 13 % of participants had high risk based on the Stop-Bang questionnaire and 10.87 % of participants had low risk. Rebelo, M.A., et al[18] performed a prospective study in 251 subjects in which 34.6 % was diagnosed with moderate obstructive sleeping apnoea as per Stop Bang questionnaire while 36.8 % with severe obstructive sleeping apnoea. In another study on 348 patients by Ong, T. H., et al.[19] Stop-Bang questionnaire identified 22.7 % under low risk and 77.3 % under high risk of obstructive sleep apnoea. In the present study, the mean ESS was 11.33 ± 5.5.

The Minimum level was 6 whereas the maximum in the study population was 22. Hesselbacher, S.et al.[20] performed a study in 1900 patients in which 10.7 ± 5.6 was the mean ESS. Among the study population, 45.65 % of participants had high ESS and remaining 54.35 % participants had low ESS. In a study conducted by EI. Sayed. I. H., et al [21] in 234 subjects, 48.1 % had low risk of obstructive sleep apnoea where as 79.1 % presented with high risk. In the present study, the mean AHI was 25.02 ± 22.42.

The Minimum level was 0 and maximum level was 88 in the study population. In a study of 234 patients by EI. Sayed., I. H., et al.[21] 45.57 ± 32.74 was the mean AHI in the study population. In the present study, 21.74 % had normal AHI whereas mild, moderate and severe AHI were identified with 21.74 %, 23.91 % and 32.61 % respectively.

In a study conducted by Chung, F., et al.[22] in 516 patients, 10% was identified with normal obstructive sleep apnoea while 32.9 %, 28.9 %, 21.5 % and 16.7 % were presented with mild, moderate and severe obstructive sleep apnoea. In the present study, the high and low ESS had sensitivity of 52.78 % in predicting AHI while specificity, false positive rate, false negative rate, positive predictive value, negative predictive value and the total diagnostic accuracy were 80 %, 20 %, 47.22 %, 90.48 %, 32 % and 58.70 %. In the study conducted by Hesselbacher, S., et al. [20] In a population of 1900 the sensitivity, specificity, positive predictive value and negative predictive value were 54 %, 57 %, 64 % and 47 % respectively.

Amra, B., et al.[23] Performed a cross sectional study in 400 patients in which the sensitivity was 59 % whereas the specificity, positive predictive value, negative predictive value, false positive rate and false negative rate were 76.47 %, 98.26 %, 7.64 %, 2.45 % and 0.53 % respectively.

In the present study the high and low STOP BANG score had sensitivity of 97.22 % in predicting OSA, The specificity, false positive rate, false negative rate, positive predictive value, negative predictive value and the total diagnostic accuracy in the study population were 40 %, 60 %, 2.78 %, 80 % and 84.78 %. EI. Sayed., I. H., et al.[21]

Performed a cross sectional study in 234 participants in which the specificity of stop bang questionnaire for the obstructive sleep apnoea was 97.55 % whereas specificity, positive predictive value, negative predictive value, false positive rate and false negative rate were 26.32 %, 93.43 %, 50%, 1.32 % and 0.09 % respectively. In a cross sectional study of 400 patients by Amara, B., et al.[23] the sensitivity, specificity, positive predictive value, negative predictive value, false positive rate and false negative rate were 81.46 %, 82.35 %, 99 %, 16.47 %, 4.50 % and 0.13 % respectively.

In the present study Stop Bang questionnaire and ESS were found with highest sensitivity and specificity in predicting obstructive sleep apnoea respectively. Also, they were presented with uppermost methodological-validity, realistic accuracy and easy to use features in various studies. Questionnaire can be a suitable valuation instrument for the abrupt diagnosis and appropriate management.

CONCLUSIONS

The study was done to compare the ability of Stop-Bang questionnaire and Epworth Sleepiness Scale in the diagnosis of OSA. Stop Bang questionnaire was seen to have the best sensitivity and the diagnostic accuracy compared to the ESS. Specificity was higher for ESS. Questionnaires used for diagnosis have a lesser clinical value compared to laboratory result.

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