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THE UTILITY OF STOP-BANG QUESTIONNAIRE IN SCREENING OSA IN PATIENTS WITH HEMORRHAGIC STROKE

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Abstract

Objective:

To determine the utility of STOP-BANG questionnaire in screening obstructive sleep apnea (OSA) in patients with hemorrhagic stroke.

Study design:

Cross-sectional study

Place and duration:

Neurology Department of Pak Emirates Military Hospital, Rawalpindi, for a duration of 6 months i.e. from July/2024 till Dec/2024

Patients and methods:

After obtaining written informed consent, 220 patients who met the selection criteria were enrolled. All patients underwent assessment for OSA according to the STOP-BANG questionnaire within 24 hours of hemorrhagic stroke, followed by polysomnography (PSG) and presence of OSA was noted down and findings were subjected to statistical analysis.

Results:

The median (IQR) age of the patients was 50 (16) years. The median BMI of the patients was 26.3 (4.4) and the median NIHSS score was 5 (3). There were 123 (55.9%) males and 97 (44.1%) females in the study. OSA on STOP-BANG questionnaire was present in 108 (49.1%) patients. OSA on PSG was present in 97 (44.1%). STOP-BANG questionnaire was 95.9% sensitive, 87.8% specific and 91.4% accurate.

Conclusion:

For screening OSA in hemorrhagic stroke patients, STOP-BANG questionnaire had a high accuracy i.e. 91.4%

INTRODUCTION

Stroke continues to rank as the world's 2nd leading cause of death and the 3rd leading cause of death and disability combined[1]. Reducing the incidence of both initial and recurrent strokes requires paying attention to the modifiable risk factors (diabetes, hyperlipidemia, atrial fibrillation, hypertension and

quitting smoking) of stroke[2]. Screening for obstructive sleep apnea (OSA) risk is a controllable stroke risk factor that is frequently disregarded. Undiagnosed OSA is much more common in stroke patients, and such patients typically have worse functional results and a higher death rate[3].

OSA results in sporadic airflow disruptions because of a reduction in the tone of the dilator muscle of pharynx. OSA causes oxidative stress and systemic inflammation, results in platelets activation, disturbs the function of vascular endothelium, and exposes the brain and body to cycles of hypoxia and awakening. OSA affects 61% of stroke survivors, making it a common comorbidity and risk factor following both events[4]. Overall, sleep apnea raises the risk of stroke by around four times and, if untreated, increases death by over three times despite controlling for other vascular risk factors. Sleep apnea is an independent predictor of longer hospital stays, lower functional outcomes, and increased functional disability following a stroke[5].

According to the American Heart Association's 2014 stroke prevention guidelines, screening for sleep disorders like OSA may be taken into consideration[6]. It is rare, nevertheless, to screen for OSA in stroke patients. Numerous reasons restrict routine screening and assessment; the challenge of doing polysomnography (PSG) in a sleep laboratory is one of the main causes of the underdiagnosis of OSA post-stroke. PSG is expensive, time-consuming, and not widely available. Additionally, many patients may not want to spend the night in a lab[7]. After a stroke, it has been determined that home sleep apnea tests (HSATs) are practical for unattended usage. HSATs are not available in many institutions, though, and some stroke clinics could find them too expensive for regular use.

To determine which patients are at high or low risk for OSA, basic screening questionnaires have been created[8]. It has been demonstrated that the "STOP-BANG" questionnaire (SBQ) has excellent methodological quality when it comes to OSA screening. Those who are at low risk for OSA can be found with this quick and easy screening technique, which will save time and money on PSGs and/or HSATs[9, 10].

There has been limited work examining the use of the SBQ in stroke patients. Keeping this in view, the current study aimed to determine the utility of SBQ for screening OSA in patients with hemorrhagic stroke. The results of this study would provide guidance about the usefulness of the simple and concise screening instrument which can save the time of neurologists as well as reduce the costs of other tests used for sleep related disorders and would also help in determining those patients who are at low risk for OSA. Thus, by establishing earlier diagnosis of OSA with this screening tool, the risk management of further stroke can be improved.

PATIENTS AND METHODS:

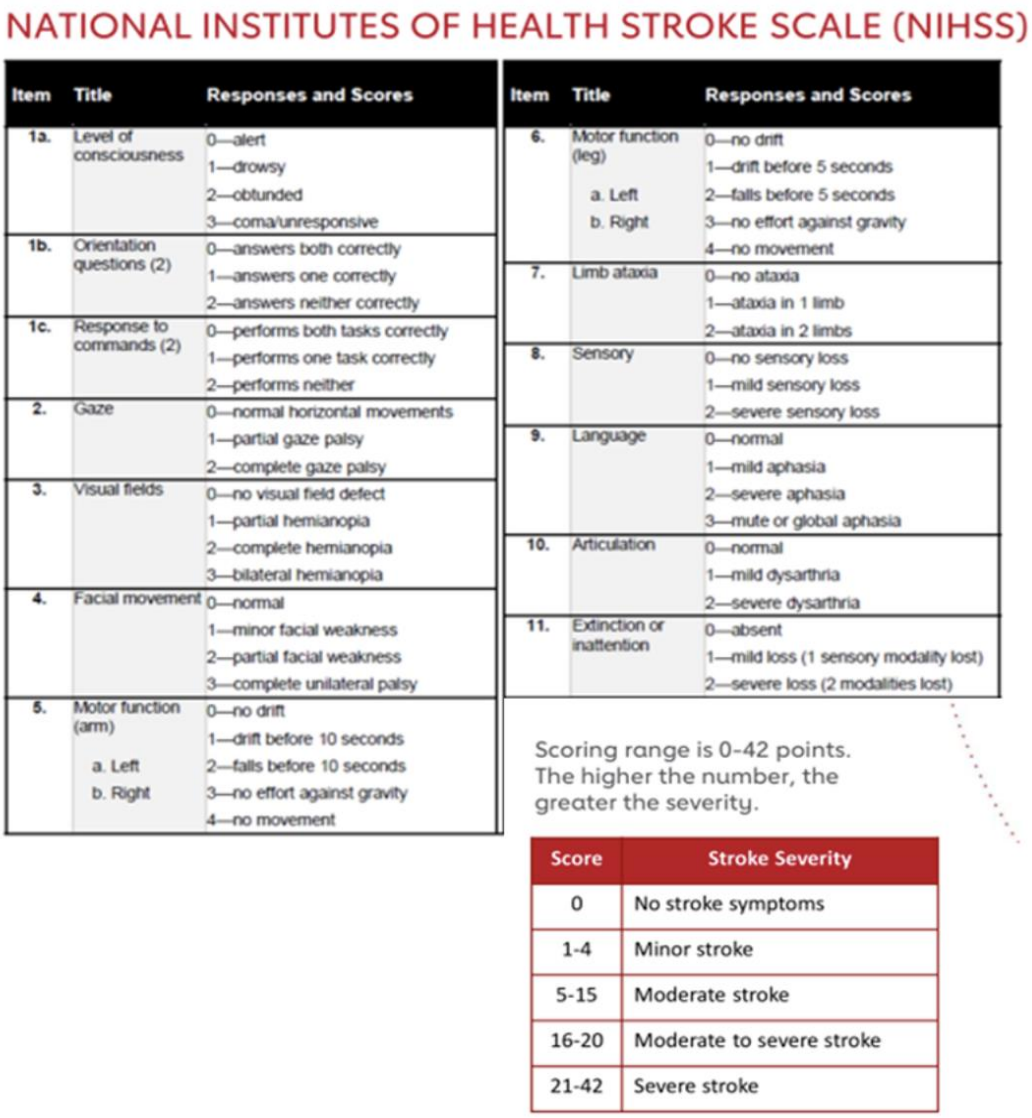
The study had a cross-sectional design. After receiving approval from the Ethical Review Committee, the study was conducted for six months, from July/2024 to Dec/2024, at the Neurology Department of the Pak Emirates Military Hospital in Rawalpindi. The study enrolled 220 patients who had hemorrhagic stroke. The sample size of 220 patients was calculated by keeping 95% confidence level, 5% margin of error, taking expected frequency of OSA in hemorrhagic stroke as 82.7%[11]. Non-probability consecutive sampling technique was used.

Inclusion criteria: The study included patients aged 18 to 70 years, of both genders and who had acute hemorrhagic stroke and had a National Institutes of Health Stroke Scale (NIHSS) score of ≤9 (Table-I).

Exclusion criteria: Patients were excluded if they were profoundly dysarthric, globally aphasic, or unable to respond to inquiries due to a language barrier, cognitive impairment, or poor comprehension, with a NIHSS score of >9, with TIA, presence of OSA before having stroke and were on palliative care.

Acute hemorrhagic stroke was defined if there was an episode of focal neurological dysfunction that persisted for more than 24 hours and hyperdense area was present on CT scan. OSA on PSG was labeled by the existence of respiratory muscle exertion associated with apneic episodes. Clinically relevant apneic episodes were defined as those that lasted 10 seconds or more and the majority of apneic episodes occurred during REM sleep. OSA on SBQ was labeled if the patient scored ≥3.

Figure 1: NIHSS obtained from American Stroke Association[12]



NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS)

Item	Title	Responses and Scores
1a.	Level of consciousness	0—alert 1—drowsy 2—obtunded 3—coma/unresponsive
1b.	Orientation questions (2)	0—answers both correctly 1—answers one correctly 2—answers neither correctly
1c.	Response to commands (2)	0—performs both tasks correctly 1—performs one task correctly 2—performs neither
2.	Gaze	0—normal horizontal movements 1—partial gaze palsy 2—complete gaze palsy
3.	Visual fields	0—no visual field defect 1—partial hemianopia 2—complete hemianopia 3—bilateral hemianopia
4.	Facial movement	0—normal 1—minor facial weakness 2—partial facial weakness 3—complete unilateral palsy
5.	Motor function (arm) a. Left b. Right	0—no drift 1—drift before 10 seconds 2—falls before 10 seconds 3—no effort against gravity 4—no movement
6.	Motor function (leg) a. Left b. Right	0—no drift 1—drift before 5 seconds 2—falls before 5 seconds 3—no effort against gravity 4—no movement
7.	Limb ataxia	0—no ataxia 1—ataxia in 1 limb 2—ataxia in 2 limbs
8.	Sensory	0—no sensory loss 1—mild sensory loss 2—severe sensory loss
9.	Language	0—normal 1—mild aphasia 2—severe aphasia 3—mute or global aphasia
10.	Articulation	0—normal 1—mild dysarthria 2—severe dysarthria
11.	Extinction or inattention	0—absent 1—mild loss (1 sensory modality lost) 2—severe loss (2 modalities lost)

Scoring range is 0-42 points.
The higher the number, the greater the severity.

Score	Stroke Severity
0	No stroke symptoms
1-4	Minor stroke
5-15	Moderate stroke
16-20	Moderate to severe stroke
21-42	Severe stroke

After obtaining written informed consent, all individuals who met the selection criteria were recruited. All patients' demographic information, clinical histories, and physical examinations were completed at baseline, and the researcher recorded the results on a pre-made proforma. All patients were interviewed according to STOP-BANG questionnaire within 24 hours of establishing the diagnosis of hemorrhagic stroke. This survey used an 8-point rating system with yes/no questions. The STOP portion of the questionnaire (snoring, tired, observed pauses, and blood pressure treatment) was obtained by interviewing the participant. The BANG portion of the questionnaire (BMI, age, and gender) was obtained on history and clinical examination. Presence of OSA according to the questionnaire was noted down and was categorized as moderate risk if the score was 3-5 and high risk if the score was >5. All patients then underwent PSG and OSA was observed and findings were noted down on the proforma and were compared. All findings were then subjected to statistical analysis.

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Shapiro-Wilk test was

used to assess the normality of data. As the data was non-normal in distribution so median (IQR) for quantitative data such as age, BMI and NIHSS score, was recorded. For qualitative data i.e. gender, presence of OSA on STOP-BANG questionnaire and on PSG, risk of OSA according to questionnaire, the frequency and percentage was computed. Sensitivity (Sn), specificity (Sp), PPV, NPV, and diagnostic accuracy of STOP-BANG questionnaire for OSA, using PSG findings as the gold standard, were calculated using a 2×2 contingency table. The diagnostic accuracy was calculated using the following formulas and parameters:

Sn: a / a+c x 100
Sp: d / b+d x 100
PPV: a / a+b x 100
NPV: d / c+d x 100
Accuracy: a+d / a+b+c+d x 100
True Positive: OSA present on both STOP-BANG and PSG.
True negative: OSA absent on both STOP-BANG and PSG
False Positive: OSA present on STOP-BANG but absent on PSG
False Negative: OSA absent on STOP-BANG but present on PSG

RESULTS:

A total of 220 patients were enrolled. The median (IQR) age of the patients was 50 (16) years. The median BMI of the patients was 26.3 (4.4) and the median NIHSS score was 5 (3) (Table-I).

There were 11 (5%) patients of age group 18 to 30 years, 99 (45%) patients of age group 31 to 50 years and 110 (50%) patients of age group 51 to 70 years. There were 123 (55.9%) males and 97 (44.1%) females in the study. OSA on STOP-BANG questionnaire was present in 108 (49.1%) patients, out of which moderate risk of OSA was yielded in 80 (36.4%) patients and severe risk was yielded in 28 (12.7%) patients. OSA on PSG was present in 97 (44.1%) (Table-II).

STOP-BANG questionnaire was found to have a Sn of 95.9%, Sp of 87.8%, PPV of 86.2%, NPV of 96.5% and an accuracy of 91.4% (Table-III).

Table-I: Median (IQR) of Quantitative Variables (n=220)

Variables	Median (IQR)
Age (in years)	50 (16)
BMI (in kg/m^2)	26.3 (4.4)
NIHSS score	5 (3)

Table-II: Frequency of qualitative variables (n=220)

Variables	Frequency (percentage)
Age group: 18 to 30 years 31 to 50 years 51 to 70 years	 11 (5%) 99 (45%) 110 (50%)
Gender: Male	 123 (55.9%)

Female	97 (44.1%)
OSA on STOP-BANG questionnaire: Present Absent	 108 (49.1%) 112 (50.9%)
Risk of OSA according to STOP-BANG: Moderate Severe	 80 (36.4%) 28 (12.7%)
OSA on PSG: Present Absent	 97 (44.1%) 123 (55.9%)

Figure-III: 2x2 table for determining diagnostic accuracy of STOP-BANG questionnaire for OSA keeping PSG scan as gold standard (n=220)

OSA on STOP-BANG questionnaire	OSA on PSG	
	Yes	No
Yes	a (true positive) 93 (42.3%)	b (false positive) 15 (6.8%)
No	c (false negative) 4 (1.8%)	d (true negative) 108 (49.1%)

Sn = 95.9%
Sp = 87.8%
PPV = 86.2%
NPV=96.5%
Diagnostic accuracy= 91.4%

DISCUSSION:

The current study findings revealed that in patients with hemorrhagic stroke, the diagnostic accuracy of SBQ for detecting OSA was high i.e. 91.4%. Majority of the patients in our study were males and were of age group 51 to 70 years.

OSA is closely linked to a higher risk of coronary artery disease, stroke, hypertension, traffic accidents, and death[13]. Early detection and intervention are essential in the management of OSA in order to avoid such negative outcomes[14,15]. The gold-standard diagnostic technique, polysomnography, is costly and necessitates expert staff and equipment, making it less accessible to many people[16]. Most of the time, there are lengthy wait times even if a polysomnography is ordered[17]. A number of screening instruments have been created to identify those who are at a high risk of developing OSA[18]. Among these, the SBQ has shown a high sensitivity in identifying OSA of moderate to severe intensity[19,20]. However, little is known about its utility in patients with stroke. Keeping this in view, the current study aimed to assess the diagnostic accuracy of SBQ for screening OSA in patients with hemorrhagic stroke keeping PSG as gold standard.

Our study results showed that STOP-BANG questionnaire was found to have a Sn of 95.9%, Sp of 87.8%, and an accuracy of 91.4% for detecting OSA

in hemorrhagic stroke patients. Boulos *et al.* in a study revealed that in stroke patients the sensitivity of STOP-BANG for detecting OSA was 93.8%[19]. Kang *et al.* in a study revealed that in patients with risk for cardiovascular morbidity, STOP-BANG had a sensitivity of 92.9% and specificity of 43%[20]. Hwang *et al.* found out that the sensitivity of SBQ for detecting OSA was 89.1% in patients who had cardiovascular risk factor[7]. Severine *et al.* revealed that the OSA risk was identified in 88% patients who had a cerebrovascular accident by using STOP-BAND questionnaire[8]. In another study by Boulos *et al.*, the sensitivity of STOP-BAND for diagnosing OSA after stroke was 83.5%[4]. These findings are consistent with our study results revealing that STOP-BAND has a high sensitivity and accuracy and thus support the usefulness of SBQ for detecting OSA in patients suffering from stroke.

The OSA screening instrument, the SBQ, should be added to the inpatient assessment of stroke in a hospital setting to increase the degree of management of risk factors related to stroke through early identification by screening and, if appropriate, recommendations for investigation and treatment. This offers an opportunity to better control the risk factors related to stroke in the future for those affected, in addition to identifying those who are at risk for OSA.

Conclusions:

The current study concluded that for screening OSA in hemorrhagic stroke patients, SBQ had a high accuracy i.e. 91.4% and proposed that it was a valuable tool for screening OSA in patients with hemorrhagic stroke and thus can be conveniently applied on the patients for establishing diagnosis and avoiding the need of undergoing PSG, which needs time and is costly, thus could add to the distress of the patients suffering from stroke. Future studies must be carried out on a larger sample in order to validate the findings of the current study.

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LIMITATIONS:

There were certain limitations of the study. Results of this study cannot be generalised because it was a single center study with a small sample size. Secondly, the usefulness of the questionnaire in patients with ischemic stroke for screening OSA was not assessed. Lastly, patients with lesser severity of stroke were enrolled in the current study, so it cannot be commented if these results can be similarly obtained in those with severe hemorrhagic stroke.

Conflict of interest: None
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