Association, Incidence and Clinical Profile of Patients with Obstructive Sleep Apnea and First-Onset Stroke in a Tertiary Hospital: A Prospective Descriptive Study

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ABSTRACT

Objective: To determine the association, incidence, and clinical profile of patients with Obstructive Sleep Apnea (OSA) and first-onset stroke admitted and managed in a tertiary hospital using the STOP-BANG and Berlin questionnaire.

Design: This is a prospective descriptive study.

Participants: Patients 18 years old and above diagnosed with first-onset cerebrovascular disease by their neurologist were qualified for this study. This study included patients presenting as hemiparesis or hemiplegia, sensory or cranial nerve deficits; with hemispheric or brainstem lesions and with evidence of cerebral infarction or hemorrhage on either CT scan or MRI of the head.

Results: 172 first-onset stroke patients were identified from July to September 2014. 52 patients fulfilled the inclusion criteria. Using the Stop-Bang questionnaire, 71.1% of the 52 patients were identified to be of high risk of having OSA. Older male patients with neck circumferences greater than 40 cms, a BMI greater than 35kg/m^2 and those observed to stop breathing during their sleep are of high risk of having OSA. Of those patients with high-risk of OSA, 91.9% have hypertension. More than half (54.1%) had thrombotic stroke, while 27% and 18.9% had hemorrhagic and cardioembolic strokes, respectively. For the Berlin questionnaire, 69.2% of the same set of patients were diagnosed to have a likelihood of Sleep Apnea. Just like the results obtained using the Stop-Bang questionnaire, patients with likelihood of Sleep apnea using the Berlin questionnaire were found to be older, mostly males, with higher BMI, and with greater neck circumferences. 88.9% of patients with likelihood of sleep apnea have hypertension. Of the subject population, 42.3% were smokers, and 40.4% consume alcohol. 54.1% of those with high risk of OSA had thrombotic stroke, versus 27% and 18.9% of hemorrhagic and cardioembolic strokes, respectively.

Conclusion: There is a direct association and increased incidence of OSA in first-onset stroke based on the risk factors involved and the number of patients who tested positive for the Stop-Bang and Berlin questionnaire. Those who have OSA in Stop-Bang are likely also to have OSA in Berlin. Older age, male gender, a higher BMI, greater neck circumferences, smoking, hypertension and those observed to stop breathing during sleep have an increased risk or likelihood of OSA. Thrombotic stroke is the most common type of stroke seen, with 38.5% located at the subcortical area. Half of the lesions were noted at the right side of the brain, with patients initially presenting with left-sided hemiparesis and/ or dysarthria.

INTRODUCTION

Among known risk factors for stroke are age, sex, hypertension, diabetes mellitus, smoking, and a history of cardiovascular disease. Obstructive sleep apnea (OSA), however, is not widely considered as a risk factor for stroke. In the local setting, this has been commonly overlooked and not included in the investigations of a stroke patient.

The most effective means of diminishing stroke-related burden is by reducing the incidence of first-time and recurrent stroke. Therefore, recognizing and treating modifiable risk factors are of particular importance.[1] As mentioned earlier, besides the well-known modifiable risk factors, such as hypertension, diabetes mellitus, heart disease, smoking, excessive alcohol use, and hypercholesterolemia—obstructive sleep apnea (OSA) is emerging as an important risk factor.[1] It is crucial for stroke patients to be screened for sleep apnea because untreated sleep apnea increases the chances of a second stroke and small studies have found that stroke patients with sleep apnea tended to have worse rehabilitation outcomes.[2]

Obstructive Sleep Apnea (OSA) is associated with significant morbidity, including excessive daytime sleepiness, loud snoring during sleep, refractory hypertension, and impaired quality of life.[3] Obstructive sleep apnea syndrome (OSAS), characterized by repeated episodes of upper airway obstruction during sleep that lead to significant hypoxemia, is a prevalent disorder particularly among middle-aged men, though its existence in women is increasingly recognized.[1]

Polysomnography (PSG) is the gold standard in the diagnosis of Obstructive Sleep Apnea. One of the barriers to study the prevalence of OSA in patients is the difficulty with recruiting patients to undergo polysomnography.[3] It is a time-consuming and costly procedure.

Further, the growing awareness of sleep apnea has exacerbated the long waiting list in many sleep laboratories. Thus, screening questionnaires and clinical screening models have been developed to help identify patients with OSA.[4]

According to the Egyptian Journal of Tuberculosis and Chest diseases in 2012, the occurrence of OSA is far more prevalent than can be handled by the available sleep laboratories.[5] Therefore, as mentioned earlier, a screening tool is necessary to stratify patients based on their clinical symptoms, their physical examinations, and their risk factors, in order to ascertain patients at high risk and in urgent need of PSG and/or further treatment and patients at low risk who may not need PSG.[5]

There are many screening tools that can be used in detecting OSA. A study done in 2011 by Silva et al compared the use of variable screening tools in identifying patients with Sleep-Disordered Breathing (SDB).[6] According to the study, STOP-Bang questionnaire had the highest sensitivity in predicting moderate-to-severe (87.0%) and severe (70.4%) SDB.[6] When in terms of specificity, a recent systematic review done by Abrashami et al showed the Berlin questionnaire to have the highest specificity overall in determining Sleep-Disordered Breathing (SDB), of which OSA is the most common such disorder.[7]

The aim of this study is to identify the association, incidence and clinical profile of patients with Obstructive Sleep Apnea and first-onset stroke in a tertiary hospital using the STOP-BANG and Berlin questionnaires.

REVIEW OF RELATED LITERATURE

Obstructive sleep apnea (OSA) is frequent in acute stroke patients and is associated with increased mortality and poor functional outcome.

In a study done by Camilo et al, OSA is detected in ischemic stroke patients who underwent full -night polysomnography at the first night after symptom onset.[8] Palomake and colleagues studied 167 men with stroke and found that 35.5% experienced their strokes during sleep.[9] Using stepwise multiple logistic regression analysis, they showed that among possible risk factors for stroke (snoring, age, body mass index, smoking, alcohol consumption, and diabetes mellitus), only snoring was significantly related to stroke in sleep.[9] They also reported that the odds ratio of snoring as a risk factor for stroke was strongly

increased if snoring was accompanied by excessive daytime sleepiness and obesity. These findings suggest that obstructive sleep apnea syndrome is a risk factor for stroke.[9]

The Canadian Stroke Congress in 2012 considered Obstructive Sleep Apnea as both a risk factor for stroke and a complication following stroke. Researchers said that among the general population, sleep apnea increases the likelihood of having a stroke, even after controlling for other stroke risk factors, such as high blood pressure and diabetes.[2]

According to Durgan et al, the incidence of OSA in patients who have had a stroke or transient ischemic attack is greater than that of the general population.[10] Patients presenting with stroke or transient ischemic attack were 3 to 4 times more likely to have OSA than were matched control subjects.[10] Their study points to strong evidence indicating that: OSA is an independent risk factor for stroke, it exacerbates damage produced by a stroke, it increases the risk for a subsequent stroke, and it contributes to brain atrophy and dementia in the elderly.[10] OSA interferes with the basic control mechanisms for regulating cerebral blood flow (CBF) by decreasing resting CBF, impairing autoregulation, and reducing cerebrovascular reserve.[10] These alterations to normal cerebrovascular control interfere with brain function and render the brain more vulnerable to ischemic events, leading to a cerebrovascular event.[10]

A study done by Silva et al in 2011: Identification of Patients with Sleep Disordered Breathing: Comparing the Four-Variable Screening Tool, STOP, STOP-Bang, and Epworth Sleepiness Scales, in terms of sensitivity, the STOP-Bang tool identified more subjects with moderate-to-severe SDB and severe SDB. The STOP-Bang performed better than the STOP questionnaire.[6] A local study done by Jorge et al in 2012 at Philippine General Hospital showed the use of the Berlin questionnaire in identifying populations at risk for sleep apnea syndrome.[11] They concluded that the Berlin Questionnaire (BQ) showed high construct validity and can be used as a research tool to conduct studies on risk assessment and disease correlation with OSA in the local community.[11] It may also be used as a screening tool in order to identify patients who may need further workup for OSA.[11]

Other questionnaires have been proposed for screening SDB. In their meta-analysis, Ramachandran and Joseph evaluated several clinical screening tests for obstructive sleep apnea, including the American Society of Anesthesiologists (ASA) checklist, the Berlin questionnaire, the Sleep Questionnaire, the sleep disorders questionnaire (SDQ) and the STOP and STOP-Bang questionnaires.[12] The authors concluded that the Berlin questionnaire and the SDQ were the most accurate questionnaires overall to screen for SDB.[12] They also concluded that the ESS was the least accurate, and that the STOP questionnaire, although the simplest tool, was a poor predictor of SDB, as was the ASA screening tool.[12] The authors, however, identified the STOP-Bang questionnaire as an excellent method for predicting severe SDB due to its simplicity and relatively ease of use rather than incorporating tools with more complex scoring methods into standard preoperative evaluations.[12]

OBJECTIVES

General Objective

To determine the association, incidence, and clinical profile of patients with Obstructive Sleep Apnea (OSA) and first-onset stroke admitted and managed in a tertiary hospital using the STOP-BANG and Berlin questionnaire.

Specific Objectives:

a. To determine the demographic profile as to age, gender, anthropometric measurements, pertinent medical and social history of OSA patients that contribute to the development of stroke.
b. To determine the association of Obstructive Sleep Apnea among first-onset stroke patients using the "STOP BANG" and Berlin Questionnaire.

METHODOLOGY

Study Design

This is a prospective descriptive study conducted among at least 30 patients with first-onset stroke, admitted and managed by the Section of

Neurology in a tertiary hospital during the period of July 1, 2014 to September 30, 2014. All participants were required to sign an informed consent. This study was done in accordance to the ethical principles of the Declaration of Helsinki and the National Ethics Guidelines for Health Research.

Inclusion criteria

Patients 18 years old and above diagnosed with first-onset cerebrovascular disease by their neurologist are qualified for this study. The diagnosis of stroke is according to The Stroke Data Bank, and National Institute of Neurological and Communicative Disorders. This study include patients presenting as hemiparesis or hemiplegia, sensory or cranial nerve deficits; with hemispheric or brainstem lesions and with evidence of cerebral infarction or hemorrhage on either CT scan or MRI of the head.

Exclusion criteria

Exclusion criterion disqualified patients with aphasia, with previous diagnoses of sleep disordered-breathing, those who have restless leg syndrome, narcolepsy, on current CPAP treatment, with unstable comorbidities (cardiac or respiratory failure), and on ventilatory dependence.

Data Collection Procedure

A total of 172 first-onset stroke patients were identified from July 2014 to September 2014. Fifty-two (52) patients fulfilled the inclusion criteria. Exclusion criterion disqualified one hundred twenty (120) patients due to a variety of factors: forty (40) patients have previous histories of stroke at the time of admission, thirty-five (35) patients have transient ischemic attacks on admission with no evidence of neurologic deficits and infarcts or hemorrhages on neuroimaging, twenty-nine (29) have unstable co-morbidities and were unable to give an informed consent (ie, active Upper Gastrointestinal Bleeding , septic shock, Alzheimer's disease, Parkinson's Dementia, congestive heart failure, on hemodialysis treatment, and myocardial infarction), seven (7) patients were on ventilatory dependence due to Pneumonia, six (6) have concomitant Subarachnoid hemorrhages and head trauma, two (2) presented with global aphasia and had difficulty in comprehension, and one (1) patient was previously diagnosed with OSA and was on CPAP treatment. All subjects signed an informed consent. Their respective sleep partners were also asked for verification of patients' answers.

1. Clinical Characteristics:

The following information were collected for each patient during the interview:

a. Baseline demographic data: (patient's name, age, gender, handedness, marital status, occupation)

b. Anthropometric measurements: (height (in centimeters), weight (in kilograms), neck size or collar size (in centimeters), and body mass index (BMI) (calculated in $kg/m^{2)}$)

c. Pertinent medical histories: (such as previous transient ischemic attacks (TIA) or strokes, and concomitant diseases that are among modifiable risk factors of stroke such as hypertension, diabetes, cardiovascular disease and hypercholesterolemia)

d. Social history: (former or current smoking history, and alcohol consumption)

e. Stroke ictus and stroke data (lateralization, location and type of lesion) was also documented.

2. Obstructive Sleep Apnea screening tool: Complaints of habitual snoring, excessive daytime sleepiness, and witnessed apneas before stroke were assessed through screening tools. Participants and their sleep partners were asked to answer questionnaires through interview conducted by the primary investigator. These were administered within 24-48 hours of admission

Research Instrument

The data sheet contained the demographic profile containing the patient's personal information, as well as pertinent past medical and social history and current medications. The type, location and lateralization of stroke during admission were also documented.

For this study, the "STOP – BANG" and the Berlin questionnaires were used on all participants as well as their respective sleep partners. Studies have showed that these have the highest sensitivity and specificity, respectively, in identifying patients with OSA.

The "STOP-BANG" questionnaire is a concise and easy-to-use screening tool for OSA. It has been developed and validated mainly in surgical patients at preoperative clinics. Combined with body mass index, age, neck size, and gender, it has a high sensitivity, especially for patients with moderate to severe OSA. It was formed after the consensus from a group of anesthesiologists and sleep specialists, and a literature review.[5] The STOP-BANG questionnaire (Appendix II) consists of the following eight questions: S—"Do you **S**nore loudly (louder than talking or loud enough to be heard through closed doors)?" T—"Do you often feel **T**ired, fatigued, or sleepy during daytime?" O—"Has anyone **O**bserved you stop breathing during your sleep?" P—"Do you have or are you being treated for high blood **P**ressure?", B---**B**MI (BMI >35 kg/m^2), A---**A**ge (>50 years old), N---**N**eck circumference (NC >40 cm), and G---**G**ender (male). The answers to all questions were designed in a simple yes/no format and the scores range from a value of 0 to 8. It scores subjects as either "high risk" or "low risk" for OSA. Answering yes to 3 or more questions is considered "high risk", whereas answering yes to less than 3 questions is considered "low risk". [5]

The Berlin questionnaire (Appendix III) consists of ten questions divided into three categories. The first category consists of five questions that deal with snoring. The second category consists of three questions that deal with waketime sleepiness. The third category asks questions on the presence of hypertension and self-reported height and weight for computation of the body mass index. Risk stratification for obstructive OSA is divided into high and low risk categories based on the responses to the questions in the three categories. [13] A Filipino Version of the Berlin Questionnaire (Appendix IV) was provided for those patients who had difficulty understanding the English language. [11]

Data Processing and Statistical Analysis

The subjects' characteristics were summarized as means ± SD for continuous variables, and counts and percentages for categorical variables. Association between categorical variables was determined using the Chi-square test for independence. Wilk-shapiro test was performed to determine whether the continuous variables are normally distributed; variables which are normally distributed will be compared using Students's t-test while those which were tested instead using the nonparametric test Mann-Whitney U-test.

Incidence proportion of having likelihood of OSA was computed by getting the number of patients which are identified to be likely to have onset OSA using Stop- Bang and Berlin questionnaires and divide it by the total number of patients initially at risk.

Cross tabulation of the result of Stop Bang and Berlin questionnaires was determined to check whether their results were in agreement. The association between the result of Stop-Bang and Berlin questionnaire was computed using the Chi-square test of independence.

Descriptive statistics of age, gender, weight, height, BMI and neck circumference were determined for each grouping produced by both Stop- Bang and Berlin questionnaires to determine the profiles of patients. Cross tabulations of the distribution of answers to items under the two questionnaires with the resulting grouping were also determined to observe which items conduce in the result.

Association of the result of Stop- Bang and Berlin questionnaires with variables under the pertinent medical history, social history and stroke data were determined to further characterize the patients with likelihood of OSA.

Cross tabulation of those variables which are significantly associated with likelihood of having OSA were constructed to observe the direction of these relationships.

RESULTS

a. Demographic Profile and Anthropometric Measurements

Baseline Demographic Data	
Handedness	*no. of patients*
Right	51 (98.1%)
Left	1 (1.9%)
Total	52
Age in years	
Mean ± SD	58.38 ± 16.11
	no of patients
45 and below	12 (23.1%)
46 to 60	19 (36.5%)
61 to 75	13 (25%)
76 and above	8 (15.4%)
Total	52
Sex	*no of patients*
Male	28 (53.95%)
Female	24 (46.1%)
Total	52
Civil Status	*no of Patients*
Single	8 (15.4%)
Married	36 (69.2%)
Widowed/Widower	8 (15.4%)
Total	52
Address	*no of patients*
Batangas	4 (7.7%)
Laguna	2 (3.9%)
Las Piñas City	1 (1.9%)
Lebanon	1 (1.9%)
Makati City	25 (48.1%)
Mandaluyong City	1 (1.92%)
Manila City	4 (7.7%)
Marikina City	1 (1.9%)
Paranaque City	4 (7.7%)
Pasay City	5 (9.6%)
Pasig City	1 (1.9%)
Quezon City	1 (1.9%)
Rizal	1 (1.9%)
South Cotabato	1 (1.9%)
Total	52

	no. of patients
Elementary Undergraduate	1 (1.9%)
High School Graduate	10 (19.2%)
College Graduate	40 (77%)
With Post-Grad Degree	1 (1.9%)
Total	52
Employment Status	*no. of patients*
Employed	22 (42.3%)
Self-employed/With own business	3 (5.8%)
Homemaker	7 (13.4%)
Retired	17 (32.7%)
Cannot/Not allowed to work	3 (5.8%)
Total	52
Month Admitted	no. of patients
July	17 (32.7%)
August	20 (38.4%)
September	15 (28.9%)
Total	52
Anthropomentric Measurements	
Height in cm (n=52)	
(mean ± SD	164.24 ± 8.72
Weight in kg (n=52)	
(mean ± SD	73.37 ± 22.17
BMI in kg/sq.m. (n=52)	
(mean ± SD	38.18 ± 4.59
	no. of patients
Underweight	1 (1.9%)
Normal	20 (38.5%)
Overweight	20 (38.5%)
Obese	11 (21.1%)
Total	52

b. Pertinent Medical and Social History

Pertinent Medical Histories	
Hypertension	*no. of patients*
No	10 (19.2)
Yes	42 (80.8%)
Total	52
Diabetes	*no. of patients*
No	39 (75%)
Yes	13 (25%)
Total	52
Dyslipidemia	*no. of patients*
No	47 (90.4%)
Yes	5 (9.6%)
Total	52
Social History	
Smoking	*no. of patients*
No	30 (57.7%)
Yes	22 (42.3%)
Total	52
Smoking Frequency	*no. of patients*
Everyday	15 (68.1%)
2 to 4 times	7 (31.9%)
Total	22
Alcohol drinking	*no. of patients*
No	31 (59.6%)
Yes	21 (40.4%)
Total	52
Alcohol Consumption	*no. of patients*
Everyday	2 (9.5%)
Once a week	3 (14.3%)
2 to 4 times a week	14 (66.7%)
1 to 2 times a month	2 (9.5%)
Total	21

c. Stroke Data

Stroke Data	
Stroke Ictus in hours	
mean ± SD	45.36 ± 103.94
	no. of patients
6 hours and below	19 (36.5%)
7 to 12 hours	11 (21.2%)
1 to 2 days	12 (23.1%)
3 days and above	10 (19.2%)
Total	52
Stroke Type	*no. of patients*
Cardioembolic	14 (26.9%)
Hemorrhagic	14 (26.9%)
Thrombotic	24 (46.2%)
Total	52
Stroke Location	*no. of patients*
Brainstem	8 (15.4%)
Corticak	5 (9.6%)
Subcortical	20 (38.5%)
Mixed	19 (36.5%)
Total	52
Stroke Lateralization	*no. of patients*
Right	26 (50%)
Left	21 (40.4%)
Bilateral	5 (9.6%)
Total	52

d. Sleep Apnea

Using the Stop-Bang questionnaire, 37 (71.1%) out of the 52 first-onset stroke patients were identified to be of high risk of having OSA. On the other hand, 36 (69.2%) of the same set of patients were diagnosed to have a likelihood of Sleep Apnea in the Berlin questionnaire.

Sleep Apnea	
STOP BANG Questionaire	*no. of patients*
Low Risk of OSA	15 (28.9%)
High Risk of OSA	**37 (71.1%)**
Total	52
Berlin Questionnare	*no. of patients*
Without likelihood of Sleep Apnea	16 (30.8%)
With likelihood of Sleep Apnea	**36 (69.2%)**
Total	52

The table below shows the comparison between results of the Berlin and Stop- Bang Questionnaire. Out of 52 patients, 11 were identified by both Stop-Bang and Berlin to have low/non-existent risk of OSA, while 32 were determined by both to have high risk of OSA. However, there are 9 patients that were differently classified by the two screening tools. Four patients which were identified by Berlin questionnaire to be with likelihood of sleep apnea are with low risk OSA in Stop-Bang questionnaire. On the other hand, five patients without likelihood of sleep apnea in Berlin questionnaire were identified by Stop-Bang questionnaire to be with high risk of OSA. With χ^2 =17.9293 and p-value=0.000, there is enough evidence to say that the results of Stop Bang and Berlin questionnaires were dependent. This shows that the results of Stop-Bang and Berlin questionnaires are associated with each other, hence those who have OSA in Stop-Bang are likely also to have OSA in Berlin.

Berlin Questionnaire	Stop Bang Questionnaire		
	Low risk of OSA	High Risk of OSA	Total
Without likelihood of Sleep Apnea	11	5	**16**
With likelihood of Sleep Apnea	4	32	**36**
Total	**15**	**37**	**52**

1. STOP-BANG QUESTIONNAIRE--

Table below shows the distribution of answers between low-risk and high-risk patients among the items under the Stop Bang questionnaire. All male patients with neck circumferences greater than 40 cms, a BMI greater than 35kg/m^2 and observed to stop breathing during their sleep are of high risk of having OSA. T-test was conducted for age and BMI to determine if the age and BMI of high-risk patients are significantly higher than that of low-risk patients. Chi-square test for independence was used to determine which among the remaining questions under Stop Bang are significantly associated with the result.

Stop Bang	Low risk of OSA (n=15)	High Risk of OSA (n=37)	Overall
Snore loudly (louder than talking or loud enough to be heard through closed doors)	5 (12.5%)	35 (87.5%)	40
Often feel tired, fatigued, or sleepy during daytime	4 (4.2%)	23 (95.8%)	24
Observed to stop breathing during sleep	0 (0%)	13 (100%)	13
Have been or being treated for high blood pressure?	7 (16.7%)	35 (83.3%)	42
BMI more than 35 kg/m^2	0 (0%)	5 (100%)	5
Age over 50 yr old	9 (25%)	27 (75%)	36
Neck circumference greater than 40 cm	0 (0%)	13 (100%)	13
Male	0 (0%)	24 (100%)	24

Table below shows the comparison of the mean age, height, weight, neck circumference and BMI of patients with low risk of OSA and high risk of OSA, and also the distribution of patients according to their age group, gender and BMI classification.

As expected, patients with high risk of OSA are those who are older, mostly males, a higher BMI, and with greater neck circumferences.

Factors		Low Risk of OSA (n=15)	High Risk of OSA (n=37)
Age	mean ± S.D.	51.8 ± 17.01	61.05 ± 15.15
		no. of patients	
	45 and below	5 (33.3%)	7 (18.9%)
	46 to 60	7 (46.7%)	12 (32.4%)
	61 to 75	1 (6.7%)	12 (32.4%)
	76 and above	2 (13.3%)	6 (16.2%)
Gender		*no. of patients*	
	Female	12 (80 %)	12 (32.4%)
	Male	3 (20%)	25 (67.9%)
Height in cm	mean ± S.D.	160.41 ± 6.20	165.8 ± 9.18
Weight in kg	mean ± S.D.	62.01 ± 9.43	78.0 ± 24.21
Neck Circumference in cm	mean ± S.D.	34.93 ± 2.19	39.5 ± 4.67
BMI	mean ± S.D.	24.07 ± 3.15	28.0 ± 6.73
		no. of patients	
	Underweight	1 (6.7%)	0 (0%)
	Normal	8 (53.3%)	12 (32.4%)
	Overweight	6 (40.0%)	14 (37.8%)
	Obese	0 (0%)	11 (29.7%)

Table at the right shows the results of the Chi -square test for independence between having risk of OSA and the following variables and also the result of the Mann-Whitney U test on determining whether the median stroke ictus of patients with high risk of OSA and those with low risk are statistically different.

At α=0.10, the civil status, employment status, and stroke type were found to be associated with having risk of OSA using the Stop Bang questionnaire. While at α=0. 05, having hypertension and other medical conditions were identified to be associated with having risk of OSA using the Stop-Bang questionnaire.

Variables	Test Statistic	p-value
Civil Status	5.04	0.081*
Educational Attainment	0.38	0.535
Employment Status	8.07	0.089*
Hypertension	10.22	0.001**
Diabetes	0.28	0.596
Dyslipidemia	0.21	0.646
Other medical condition	6.66	0.01**
Smoking	0.05	0.830
Smoking frequency	0.01	0.926
Alcohol	0.00	0.971
Alcohol Consumption	4.20	0.241
Stroke Ictus~	-0.10	0.919
Stroke Ictus Group	0.20	0.978
Stroke Type	4.79	0.091*
Stroke Location	0.68	0.879
Stroke Lateralization	0.44	0.801

~ Mann-Whitney U test used

** Significant at α=10%*

*** Significant at α=5%*

Cross tabulations of variables which are found to be associated with having risk of OSA using Stop Bang questionnaire were constructed to observe the direction of association between these variables and risk of OSA.

Patients with low and high risk of OSA were mostly married; with equal number of patients being singles and widowed/widowers. Although, the number of married patients with high risk of OSA are significantly higher than those with low risk of OSA. This could be due to the fact that age is an indicator of OSA, since older patients are more likely to be married.

Civil Status	Low risk of OSA	High Risk of OSA
Single	4 (26.7%)	4 (10.8%)
Married	7 (46.7%)	29 (78.4%)
Widowed/Widower	4 (26.7%)	4 (10.8%)
Total	**15**	**37**

Majority of both the low-risk and high-risk patients had a college degree, with very few elementary undergraduates and post-grad degree holders, which is expected since 40 of the 52 patients were college graduates. Interestingly, 29 out of the 40 patients are of high risk of OSA while only 11 were considered as low-risk.

Educational Attainment	Low risk of OSA	High Risk of OSA
Elementary Graduate	0 (0%)	1 (2.7%)
High School Graduate	4 (26.7%)	6 (16.2%)
College Graduate	11 (73.3%)	29 (78.4%)
With Post-Grad Degree	0 (0%)	1 (2.7%)
Total	**15**	**37**

Those patients with low risk of OSA are almost equally distributed between those with and those without hypertension. However, of those patients with high-risk of OSA, 91.9% have hypertension.

Hypertension	Low risk of OSA	High Risk of OSA
Without	7 (46.7%)	3 (8.1%)
With	8 (53.3%)	34 (91.9%)
Total	**15**	**37**

More than half (59.5%) of high-risk patients have other medical conditions while 80% of low-risk patients are without other medical conditions. NOTE: It may be good to explore on the other actual medical conditions of low-risk versus high-risk patients. See the list below the table.

Other Medical Conditions	Low risk of OSA	High Risk of OSA
Without	12 (80.0%)	15 (40.5%)
With	3 (20.0%)	22 (59.5%)
Total	**15**	**37**

Other Medical Conditions of Low Risk Patients
Seizure
Unstable Angina
s/p Thyroidectomy

Other Medical Conditions of High Risk Patients
Atrial fibrillation and Bronchial Asthma
Pancreatitis
s/p Bell's Palsy, Left and Polycythemia Vera
Atrial fibrillation; s/p Hip Replacement and s/p Lap Cholecystectomy
Rheumatic Heart Disease and Atrial Fibrillation
s/p Colonic Surgery
s/p Cholecystectomy
s/p Spine fracture secondary to fall; s/p Thyroidectomy with Hypothyroidism
s/p Coronary Artery Bypass Graft and Coronary Artery Disease
s/p Cholelithiases
Abdominal Aortic Aneurysm; s/p Gortex Graft
s/p Carotid Tumor Resection
Paroxysmal Atrial Fibrillation
s/p TAHBSO and s/p Appendectomy

Of the 37 high-risk patients, more than half (54.1%) had thrombotic stroke, while 27% and 18.9% had hemorrhagic and cardioembolic strokes, respectively. Distribution of low-risk patients among stroke type is different, with majority (46.7%) having experienced hemorrhagic stroke and the remaining patients evenly went through thrombotic and cardiembolic stroke.

Stroke type	Low risk of OSA	High Risk of OSA
Cardioembolic	4 (26.7%)	10 (27.0%)
Hemorrhagic	7 (46.7%)	7 (18.9%)
Thrombotic	4 (26.7%)	20 (54.1%)
Total	**15**	**37**

2. BERLIN QUESTIONNAIRE--

All patients who obtained positive results in Category 2 are with likelihood of sleep apnea, while few patients with positive responses on Categories 1 and 3 were classified to be not unlikely to have sleep apnea. Chi-square test for independence was used to determine which among the questions under Berlin are significantly associated with the result.

Berlin	Without likelihood of Sleep Apnea (n=16)	With likelihood of Sleep Apnea (n=36)	Overall
Category 1 Positive	3 (7.9%)	35 (92.1%)	38
Category 2 Positive	0 (0%)	19 (100%)	19
Category 3 Positive	6 (14.6%)	35 (85.4%)	41

Just like the results obtained using the Stop-Bang questionnaire, patients with likelihood of Sleep apnea using the Berlin questionnaire were found to be older, mostly males, with higher BMI, and with greater neck circumferences.

Factors		Without likelihood of Sleep Apnea (n=16)	With likelihood of Sleep Apnea (n=36)
Age	mean ± S.D.	53.94 ± 15.97	60.36 ± 15.99
		no. of patients	
	45 and below	5 (31.3%)	7 (19.4%)
	46 to 60	7 (43.8%)	12 (33.3%)
	61 to 75	2 (12.5%)	11 (30.6%)
	76 and above	2 (12.5%)	6 (16.7%)
Gender		*no. of patients*	
	Female	9 (56.3%)	15 (41.7%)
	Male	7 (43.8%)	21(58.3%)
Height in cm	mean ± S.D.	163.61 ± 7.18	164.53 ± 9.41
Weight in kg	mean ± S.D.	66.57 ± 17.25	76.39 ± 23.63
Neck Circumference in cm	mean ± S.D.	35.38 ± 2.63	39.43 ± 4.74
BMI	mean ± S.D.	24.64 ± 4.92	27.85 ± 6.46
		no. of patients	
	Underweight	1 (6.3%)	0 (0%)
	Normal	9 (56.3%)	11 (30.6%)
	Overweight	5 (31.3%)	15 (41.7%)
	Obese	1 (6.3%)	10 (27.8%)

There were only two variables found to be associated with having likelihood of Sleep Apnea using Berlin Questionnaire. Interestingly, these two variables, which are having hypertension and other medical conditions, were consistent in the sense that these two were also found to be associated with risk of OSA using the Stop-Bang questionnaire.

Variables Associated With likelihood of Sleep Apnea	Test Statistic	p-value
Civil Status	4.01	0.135
Educational Attainment	0.08	0.777
Employment Status	0.06	1.000
Hypertension	4.97	0.026**
Diabetes	0.48	0.448
Dyslipidemia	0.30	0.583
Other medical condition	2.62	0.105*
Smoking	0.56	0.454
Smoking frequency	0.27	0.604
Alcohol	0.08	0.777
Alcohol Consumption	2.80	0.423
Stroke Ictus	-0.44	0.661
Stroke Ictus Group	1.48	0.687
Stroke Type	1.37	0.505
Stroke Location	0.57	0.903
Stroke Lateralization	0.98	0.612

~ Mann-Whitney U test used

** Considerably significant at α=10%*

*** Significant at α=5%*

Of the 42 patients noted to have hypertension, 32 have a likelihood of sleep apnea while only 10 have without.

Hypertension	Without likelihood of Sleep Apnea	With likelihood of Sleep Apnea
Without	6 (37.5%)	4 (11.1%)
With	10 (62.5%)	32 (88.9%)
Total	**16**	**36**

Out of the 36 patients with likelihood of sleep apnea using the Berlin questionnaire, a little over half (55.6%) have other medical conditions while 68.8% of those without likelihood of Sleep Apnea did not have other medical conditions.

Other medical conditions	Without likelihood of Sleep Apnea	With likelihood of Sleep Apnea
Without	11 (68.8%)	16 (44.4%)
With	5 (31.2%)	20 (55.6%)
Total	**16**	**36**

Other Medical Conditions of those Without Likelihood of Sleep Apnea
Pancreatitis
Seizure
Unstable Angina
s/p Thyroidectomy

Other Medical Conditions of those with Likelihood of Sleep Apnea
Abdominal Aortic Aneurysm with s/p Gortex Graft
Atrial fibrillation and Bronchial Asthma
Atrial fibrillation; s/p Hip Replacement; s/p Lap Cholecystectomy
Bronchial Asthma and Chronic Atrial Fibrillation
Paroxysmal Atrial Fibrillation
Rheumatic Heart Disease and Atrial Fibrillation
s/p Appendectomy
s/p Bell's Palsy, Left; with Polycythemia Vera
s/p Coronary Artery Bypass Graft and Coronary Artery Disease
s/p Carotid Tumor Resection
s/p Cholecystectomy
s/p Cholelithiases
s/p Colonic Surgery
s/p Spine fracture secondary to fall; s/p Thyroidectomy with Hypothyroidism
s/p TAHBSO and s/p Appendectomy

DISCUSSION

Several screening tools for obstructive sleep apnea have been proposed. However, validation studies were conducted on different populations, which limit comparisons on the predictive capabilities of these tools. In 2012, El-Sayed and colleagues compared four sleep questionnaires with regards to their predictive probabilities for OSA.[5] Of the four questionnaires (STOP, STOP-BANG, Berlin and Epworth Sleepiness Scale [ESS]), the STOP-Bang, Berlin and STOP questionnaires had the highest sensitivity to predict OSA (97.55%, 95.07% and 91.67%, respectively), moderate-to-severe OSA (97.74%, 95.48% and 94.35%, respectively) and severe OSA (98.65%, 97.3% and 95.95%, respectively), but with a very low specificity for OSA patients (26.32%, 25% and 25%, respectively), moderate-to-severe OSA patients (3.7%, 7.41% and 25.93%, respectively) and severe OSA patients (5.36%, 10.71% and 19.64%, respectively).[5] According to Silva et al in 2011, the STOP-Bang had the highest sensitivity in identifying persons with moderate-to-severe and severe OSA.[6] On the other hand, Kang et al used the Berlin questionnaire in evaluating its use and validity in OSA in Korean population.[18] Results showed that the Berlin questionnaire has a 72.1% sensitivity and 42.1% specificity at the apnea-hypopnea index (AHI) >5 level.[18] There was a moderate association between the severity of OSA and category 1 (p=0.015), and also category 2 (p=0.006).[18] A systematic review by Abrashami et al in 2010 showed the Berlin questionnaire to have a higher specificity in screening OSA.[7] To better identify patients who are at high risk and with high likelihood of OSA among first-onset stroke patients, this study used the Stop-Bang and the Berlin questionnaire.

Using the Stop-Bang questionnaire, thirty-seven (71.1%) of the fifty-two (52) patients with first-onset stroke were identified to have high-risk for OSA. On the other hand, the Berlin questionnaire showed that thirty-six (69.2%) of the same set of patients have a likelihood of sleep apnea. The difference in the results may arise from review of related literature showing that the Stop-Bang questionnaire has high sensitivity and the Berlin questionnaire has high specificity in screening patients with OSA. These questionnaires were able to identify high-risk patients for OSA but without accurately excluding those at low risk.[5]

As for the clinical profile, majority of the patients identified were right-handed. The individual's handedness was determined because distribution of the hemispheric language dominance varies with the degree of handedness. If the language area (left dominant hemisphere in most patients) is greatly affected, patients presenting with aphasia were excluded due to limitation of information that can be gathered from these individuals. Of the right-handed patients included, none were aphasic, while some presented with mild to moderate dysarthria with intact comprehension.

Most of the stroke patients were documented to have a mean age of 58.38 (± 16.11 years), males,

married, college graduates, employed, and residing within the metropolitan area. When comparing the distribution of answers between the Stop-Bang and Berlin questionnaires, those who are older, mostly males, a BMI of greater than 35 kg/m^2, those with neck circumferences of greater than 40 centimeters, are noted to be at high risk/ likelihood of OSA. This is comparable to a systematic review of literature by Mirrakhimov et al in 2013: Prevalence of obstructive sleep apnea in Asian adults. Their results showed that male gender, older age, a higher BMI and waist to hip ratio, and greater neck circumference, arterial hypertension, smoking, snoring and daytime sleepiness were associated with OSA.[16]

Using the Stop-Bang questionnaire, 91.9% percent of those with high risk of OSA have hypertension. The Berlin questionnaire also showed almost the same results; majority of those with likelihood of OSA (88.9%) have hypertension. Aside from hypertension, those with high risk/ with likelihood of OSA have other medical conditions, of which atrial fibrillation is the most common. According to a study by Dyken et al, obstructive sleep apnea has been associated with hypertension and cardiovascular disease.[15] Obstructive respiratory events can elicit excessive sympathetic and parasympathetic activation, with consequent surges in blood pressure (up to 220/130 mm Hg) and bradyarrhythmias (including complete heart block and sinus pause).[15] Hypoxia and hypoperfusion may predispose patients with obstructive sleep apnea to stroke, especially during sleep.[15] Tilkian et al hypothesized that repetitive hypertensive events associated with nocturnal apneas might lead to sustained hemodynamic abnormalities.[17]

A great number of the patients also presented with significant smoking history and frequent alcohol intake. Since the RIFASAF study has declared that smoking and alcohol intake are independent risk factors for stroke,[19] it is not unlikely that they may be associated with OSA as well. According to the Sleep Apnea In-Depth Report of the New York Times, smokers have a higher risk of sleep apnea.[14] Those who smoke more than two packs a day have a risk of 40 times greater than nonsmokers. Alcohol use may also be associated with apnea. Patients diagnosed with sleep apnea are recommended not to drink alcohol before bedtime.[14] In this study, majority (68.1%) smoke every day, while 40.4 % of alcohol drinkers consume alcohol about 2-4 times a week.

Most of the patients were admitted in less than 6 hours of symptom onset. This may be due to the increasing awareness of patients to stroke symptoms and due to their accessible location within the vicinities of hospitals. Thrombotic stroke is the most common type of stroke seen, with 38.5% located at the subcortical area while 36.5% were mixed. A journal by Dyken et al noted that brain stem strokes and other disorders causing injury to the medullary respiratory centers have been reported to produce primarily central sleep apnea.[15] However, in this study, this only ranked third (15.4%) in the most common location of stroke. Half of the strokes documented were located on the right side of the brain, with patients initially presenting with left-sided hemiparesis and/or dysarthria.

Given that OSA can continue for years without recognition and most individuals with OSA go undiagnosed because these are not commonly explored in the investigations of a first-onset stroke, it is logical that the damage to the cerebral circulation occurs over a long period of time, creating an environment that predisposes an individual to stroke and transient ischemic attacks. Because our population is aging and becoming more obese (risk factors for OSA), with contributory factors from hypertension, cardiac disease, smoking and alcoholism, the incidence of cerebrovascular disease associated with OSA should be expected to increase, and cerebrovascular disease should occur at an earlier age. It is imperative that primary care physicians and specialists be vigilant in the screening of these patients who are at high risk of OSA so as to prevent first-onset stroke.

CONCLUSION

This study shows the direct association and increased incidence of OSA in first-onset stroke based on the risk factors involved and the number of patients who tested positive for the screening tools used in this study (Stop-Bang and Berlin questionnaire). Those who have OSA in Stop-Bang are likely also to have OSA in Berlin. Older age, male gender,

a higher BMI, greater neck circumferences, smoking, hypertension and those observed to stop breathing during sleep have an increased risk or likelihood of OSA. Thrombotic stroke is the most common type of stroke seen, with 38.5% located at the subcortical area. Half of the lesions were noted at the right side of the brain, with patients initially presenting with left-sided hemiparesis and/ or dysarthria. Durgan et al cited that repeated exposures to hypoxia in individuals with OSA could lead to hypoxic/ischemic brain injury, especially if cerebrovascular control is impaired. [11] This situation predisposes an individual's brain to be vulnerable to an ischemic event, leading to stroke.

RECOMMENDATIONS

The prevalence of OSA is fairly high in international research studies. Since the diagnosis and treatment of OSA is of particular importance in stroke prevention, it is recommended in the local setting that the use of screening tool such as the STOP-BANG and Berlin questionnaire be utilized in all patients presenting with stroke. It is ideal to use screening tools with high sensitivities, like the Stop-Bang, to screen populations with high risk for OSA in order to avoid missing cases that may lead to adverse health consequences; whereas, screening tools with high specificities and the percentages of correctly classifying persons into low- and high-risk groups for OSA may take precedence in low-risk populations who demonstrate no overt signs of OSA or associated comorbidities and lack easy access to polysomnography.

All patients whose results showed high risk for developing OSA are encouraged to undergo an overnight, technician-supervised polysomnographic study (sleep study) upon the advice of the patient's attending physician. Increasing the awareness and aggressive treatment of OSA may prevent the growing number of stroke patients, both in the young and the elderly who are at risk.

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APPENDIX I

A. General Data:

Name: Handedness:
Age/Sex: Civil Status:
Address:
Contact #:
Educational attainment:
Work:
Date of admission: Attending Physician:

B. Anthropometric measurements:

Height: Neck size/ Collar size:
Weight:
Body Mass Index (BMI) kg/$m^{2)}$:

C. Medical history and its duration: Medications taken:

( ) Hypertension
( ) Diabetes
( ) Dyslipidemia
( ) Previous strokes:
    ( ) Transient Ischemic Attack:
    ( ) Ischemic Stroke:
        ( ) Thrombotic ( ) Cardioembolic
    ( ) Hemorrhagic:
( ) Others:

D. Social history:

( ) Smoking
( ) Alcohol consumption

E. Stroke Data Upon Admission:

Stroke Ictus:
Stroke Type:
( ) Ischemic: ( ) Thrombotic ( ) Cardioembolic
( ) Hemorrhagic
Stroke Location:
Stroke Lateralization:

APPENDIX II

STOP BANG Questionnaire

Height _____ inches/cm Weight _____ lb/kg
Age _____ Male/ Female ____
BMI _____ Collar size of shirt: S, M, L, XL, or _____ inches/cm
Neck circumference* _____ cm

1. ***S***noring
   Do you *s*nore loudly (louder than talking or loud enough to be heard through closed doors)?
   Yes No
2. ***T***ired
   Do you often feel *t*ired, fatigued, or sleepy during daytime?
   Yes No
3. ***O***bserved
   Has anyone *o*bserved you stop breathing during your sleep?
   Yes No
4. Blood ***P***ressure
   Do you have or are you being treated for high blood *p*ressure?
   Yes No
5. ***B***MI
   *B*MI more than 35 kg/m2?
   Yes No
6. *A*ge
   Age over 50 yr old?
   Yes No
7. ***N***eck circumference
   *N*eck circumference greater than 40 cm?
   Yes No
8. ***G***ender
   *G*ender male?
   Yes No

High risk of OSA: answering yes to three or more items
Low risk of OSA: answering yes to less than three items

Adapted from:
STOP Questionnaire: *A Tool to Screen Patients for Obstructive Sleep Apnea*. *Frances Chung, F.R.C.P.C.,* Balaji Yegneswaran, M.B.B.S.,† Pu Liao, M.D.,‡ Sharon A. Chung, Ph.D.,§Santhira Vairavanathan, M.B.B.S.,_ Sazzadul Islam, M.Sc.,_ Ali Khajehdehi, M.D.,† Colin M. Shapiro, F.R.C.P.C.#* Anesthesiology 2008; 108:812–21 Copyright © 2008, the American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.

APPENDIX III

Berlin Questionnaire

Sleep Evaluation in Primary Care

Please Complete the following:

height _____ age _____

weight _____ male/female _____

Category 1

1. Do you snore?

- ☐ yes
- ☐ no
- ☐ don't know

If you snore:

2. Your snoring is?

- ☐ slightly louder than breathing
- ☐ as loud as talking
- ☐ louder than talking
- ☐ very loud. Can be heard in adjacent rooms.

3. How often do you snore?

- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

4. Has your snoring ever bothered other people?

- ☐ yes
- ☐ no

5. Has anyone noticed that you quit breathing during your sleep?

- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

Category 2

6. How often do you feel tired or fatigued after your sleep?

- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

7. During your waketime, do you feel tired, fatigued or not up to par?

- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

8. Have you ever nodded off or fallen asleep while driving a vehicle?

- ☐ yes
- ☐ no

if yes, how often does it occur?

- ☐ nearly every day
- ☐ 3-4 times a week
- ☐ 1-2 times a week
- ☐ 1-2 times a month
- ☐ never or nearly never

Category 3

9. Do you have high blood pressure?

- ☐ yes
- ☐ no
- ☐ don't know

10. BMI > 30 (*See Chart*)

- ☐ yes
- ☐ no

Scoring Questions: Any answer within box outline is a positive response.

Scoring categories:

- ☐ Category 1 is positive with 2 or more positive responses to questions 1-5
- ☐ Category 2 is positive with 2 or more positive responses to questions 6-8
- ☐ Category 3 is positive with 1 positive responses to questions 9-10

Final Result: If 2 or more possible categories are positive, you have a high likelihood of sleep apnea.

Name _____

Address _____

_____

APPENDIX III

FILIPINO VERSION OF BERLIN QUESTIONNAIRE

PANGKAT 1

1. **Humihilik ka ba?**
   a. Oo
   b. Hindi
   c. Di ko alam

Kung humihilik ka, sagutan ang tanong 2-5 sa pangkat na ito. Kung hindi o hindi mo alam, pumunta sa tanong 5.

2. **Ang iyong paghilik ay:**
   a. Mas malakas sa paghinga
   b. Kasing lakas ng pagsasalita
   c. Mas malakas sa pagsasalita
   d. Napakalakas – maririnig sa kalapit silid

3. **Gaano kadalasa kang humilik?**
   a. Halos araw-araw
   b. 3-4 beses sa bawat linggo
   c. 1-2 beses sa bawat lingo
   d. 1-2 beses sa bawat buwan
   e. Hindi kahit kalian o halos hindi

4. **Ang hilik mo ba ay nakakabagabag sa iba?**
   a. Oo
   b. Hindi
   c. Di ko alam

5. **May nakapansin bang tumigil ka na sa paghinga sa pagtulog?**
   a. Halos araw-araw
   b. 3-4 beses sa bawat linggo
   c. 1-2 beses sa bawat lingo
   d. 1-2 beses sa bawat buwan
   e. Hindi kahit kalian o halos hindi

PANGKAT 2

6. **Gaano kadalas kang makaramdam ng pagod tapos matulog?**
   a. Halos araw-araw
   b. 3-4 beses sa bawat linggo
   c. 1-2 beses sa bawat lingo
   d. 1-2 beses sa bawat buwan
   e. Hindi kahit kalian o halos hindi

7. **Sa oras na ikaw ay gising, nakaramdam ka ba ng pagod?**
   a. Halos araw-araw
   b. 3-4 beses sa bawat linggo
   c. 1-2 beses sa bawat lingo
   d. 1-2 beses sa bawat buwan
   e. Hindi kahit kalian o halos hindi

8. **Naidlip ka na ba o nakatulog habang nagmamaneho ng sasakyan, habang naghinintay sa doktor, habang nanonood ng telebisyon sa bahay o habang nakapila sa pagbayad ng kuryente o telepono?**
   a. Oo
   b. Hindi

Kung oo, sagutan ang tanong 9. Kung hindi, pumunta sa tanong 10.

9. **Gaano kadalas ito mangyari?**
   a. Halos araw-araw
   b. 3-4 beses sa bawat linggo
   c. 1-2 beses sa bawat lingo
   d. 1-2 beses sa bawat buwan
   e. Hindi kahit kalian o halos hindi

PANGKAT 3

10. **Meron ka bang alta presyon?**
    a. Oo
    b. Hindi
    c. Di ko alam

Jorge et al. Validation of the Filipino Version of the Blin Questionnaire to Identify Population at Risk for Sleep Apnea Syndrome. Vol 46 No 3. 2012.

Informed Consent to Participate in a Research Study

Research Information	
Research Title: **Association, Incidence and Clinical Profile of Patients with Obstructive Sleep Apnea and First-Onset Stroke in a Tertiary Hospital: A Prospective Descriptive Study**	
Principal Investigator:	Department of Neuroscience- Section of Neurology
Location:	Phone:

You are being invited to take part in a research study. Before you decide whether or not to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully.

1. **PURPOSE OF THIS RESEARCH STUDY**
   - Among known risk factors for stroke are age, sex, hypertension, diabetes mellitus, smoking, and a history of cardiovascular disease. Obstructive sleep apnea (OSA), however, is not widely considered as a risk factor for stroke. In the local setting, this has been commonly overlooked and not included in the investigations of a stroke patient. The aim of this study is to identify the association and incidence of Obstructive Sleep Apnea among first-onset stroke patients admitted and managed in a tertiary hospital using the STOP-BANG and Berlin questionnaire

2. **PROCEDURES**
   - This research will involve the use of a data collection sheet and questionnaires used for the screening of OSA. The data sheet contains the demographic profile containing the patient's personal information such as name, age, sex, occupation, athropometric measurements, as well as pertinent past medical and social history and current medications. The type, location and lateralization of stroke during admission will also be documented. The "STOP – BANG" and the Berlin questionnaire will be used on all participants as well as their respective sleep partners. Studies have shown that these have the highest sensitivity and specificity, respectively, in identifying patients with OSA. All patients whose results showed high risk for developing OSA will be encouraged to undergo an overnight, technician-supervised polysomnographic study upon the advice of the patient's attending physician.

3. **FINANCIAL CONSIDERATIONS**
   - There is no financial compensation for your participation in this research.

4. **CONFIDENTIALITY**
   - Your identity in this study will be treated as confidential. The results of the study, including laboratory or any other data, may be published for scientific purposes but will not give your name or include any identifiable references to you.

5. **TERMINATION OF THE STUDY**
   - You are free to choose whether or not to participate in this study. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate.

AVAILABLE SOURCES OF INFORMATION
Any further questions you have about this study will be answered by the Principal Investigator:
Name: Phone Number:

6. **AUTHORIZATION**
   I have read and understood this consent form, and I volunteer to participate in this research study.

   Participant Name (Printed or Typed): Participant Signature:
   Date: Date:

   Principal Investigator Signature/ Signature of Person Obtaining the Consent: Date: