https://doi.org/10.1590/0004-282X20170137

ARTICLE

The critical influence of nocturnal breathing complaints on the quality of sleep after stroke: the Pittsburgh Sleep Quality Index and STOP-BANG

A influência crítica das queixas respiratórias noturnas na qualidade final do sono após acidente vascular cerebral: índice de qualidade de sono de Pittsburgh e STOP-BANG

Giuliano da Paz Oliveira[1], Eliana Regina Lottemberg Vago[1,2], Gilmar Fernandes do Prado[1], Fernando Morgadinho Santos Coelho[1,2]

ABSTRACT

In stroke patients particularly, many factors, such as sleep-related respiratory disturbances, can impair sleep. Cheap and easy-to-use tools have been created to identify sleep quality and sleep disturbances in patients after stroke. This study described the scores of the sleep apnea screening questionnaire – STOP-BANG – in patients after a stroke, and correlated the findings with sleep quality measured by the Pittsburgh Sleep Quality Index (PSQI). The scores of the STOP-BANG and PSQI were 4.3 ± 1.8 and 7.6 ± 3.9, respectively. The STOP-BANG scores were higher in poor sleepers (4.5 ± 1.6 versus 3.5 ± 1.9; p = 0.032). Logistic regression analysis was used to identify predictors of subjective sleep quality (PSQI) and the STOP-BANG as a predictor of poor quality sleep, with a relative risk of 1.6, controlled for age and sex. This study indicated that sleep quality was largely influenced by sleep breathing problems, which were well identified by the STOP-BANG, especially in younger stroke patients.

Keywords: stroke; sleep; surveys and questionnaires.

RESUMO

Especialmente em pacientes com acidente vascular cerebral (AVC), muitos fatores prejudicam o sono, como distúrbios respiratórios do sono (DRS). Ferramentas mais baratas foram usadas para identificar a qualidade do sono e distúrbios do sono após AVC. Este estudo verificou a influência das queixas DRS na qualidade do sono após AVC utilizando questionários. Nós investigamos a qualidade do sono eo risco de Apneia Obstrutiva do Sono com o Índice de Qualidade do Sono de Pittsburgh (PSQI) e Stop-Bang em 68 pacientes após AVC. As pontuações de STOP-BANG e PSQI foram de 4,3 ± 1,8 e 7,6 ± 3,9, respectivamente. As pontuações de STOP-BANG foram mais elevadas em pacientes com sono ruim (4,5 ± 1,6 versus 3,5 ± 1,9; p = 0,032). A regressão logística caracterizou o STOP-BANG como preditor de um sono de má qualidade.Estes achados confirmam a influência das queixas respiratórias noturnas na qualidade do sono após AVC.

Palavras-chave: acidente vascular cerebral; sono; inquéritos e questionários.

Sleep quality influences health and poor quality of sleep can worsen clinical conditions and impair treatment and rehabilitation in stroke patients[1,2,3]. The impact of poor sleep quality in prevalent diseases such as stroke is enormous[4,5,6].

Sleep-related respiratory disturbances after stroke are very common (40-80%)[7]. They frequently worsen neurologic recovery and impair quality of life[8,9]. Sleep-related respiratory disturbances are independent risk factors for new strokes, as well as other cardiovascular events. The main sleep-related respiratory disturbance is obstructive sleep apnea, which is characterized by repeated interruption of ventilation during sleep due to pharyngeal airway closure with consequent sleep fragmentation and intermittent hypoxia. Obstructive sleep apnea is correlated with hypertension, diabetes, obesity, stroke, heart

[1]Universidade Federal de São Paulo, Departamento de Neurologia e Neurocirurgia, São Paulo SP, Brasil;

[2]Universidade Federal de São Paulo, Departamento de Psicobiologia, São Paulo SP, Brasil.

Correspondence: Fernando Morgadinho Santos Coelho; Departamento de Neurologia e Neurocirurgia da UNIFESP; Rua Napoleão de Barros, 925 / 2º andar; 04024-002 São Paulo SP, Brasil; E-mail: fernandomorgadinho@hotmail.com

Conflict of interest: There is no conflict of interest to declare.

Received 28 March 2017; Received in final form 16 June 2017; Accepted 08 August 2017.

attack and a higher incidence of death[4,10,11]. The prevalence of obstructive sleep apnea is three-to-four times higher in patients after a stroke[12].

The high cost and prevalence of stroke associated with a greater frequency of sleep disorders justify efforts to determine the best option to identify this overlap. The diagnosis and treatment of sleep disorders is a field that has expanded considerably over recent years.

Unfortunately, the traditional investigation of sleep disturbance is expensive and complicated. This makes it impossible to perform sleep studies for the major portion of stroke patients, in almost all parts of world. However, the physical and cognitive impairment of stroke patients with sleep disorders always needs to be considered in the clinical approach[2,13]. Thus, cheaper and easier-to-use tools have been created to identify sleep quality and sleep disturbances in patients after stroke – namely, the Pittsburgh Sleep Quality Index (PSQI) and the sleep apnea screening questionnaire – STOP-BANG[14,15].

The PSQI is the most complete questionnaire for determining sleep quality, with seven components: subjective sleep quality, latency, duration, efficiency, sleep disorders, use of sleep medication and daytime dysfunction. Part of the PSQI covers sleep-related respiratory disturbances; however, it is frequently not used in clinical practice due its length. For an exclusively sleep-related respiratory disturbance investigation, the STOP-BANG can be used. This questionnaire is easier to use in clinical practice[15,16].

The aim of this study was to describe the scores of the STOP-BANG questionnaire in patients after stroke and correlate the findings with sleep quality measured by the PSQI.

METHODS

Sample and ethics

Seventy-five patients who had had a stroke (ischemic and hemorrhagic) within the last year, over 18 years of age, who attended the Neurovascular Clinic of the Universidade Federal de São Paulo (UNIFESP) consecutively, between March and June 2016, were invited to participate. This study was reviewed and approved by the Institutional Research Ethics Committee of UNIFESP (CAAE: 55362516.6.0000.5505).

The study exclusion criteria were: 1) patients younger than 18 years old; 2) uncontrolled psychiatric illness; 3) confusion or severe cognitive impairment; 4) aphasia; 5) use of sedative or hypnotic medications and 6) more than one year after stroke event. Seven patients were excluded: five patients due to aphasia and two patients due to dementia. Informed consent was obtained from all 68 patients studied.

Study design

This was a cross-sectional, observational study, in a single center – the Department of Neurology, Neurovascular Clinic of UNIFESP. Every assessment was made by filling out forms and questionnaires with the patient.

Demographic characteristics (age and gender), anthropometric features (weight, height, body mass index (BMI), and a measurement of neck circumference, and clinical characteristics (smoking status, diagnosis of systemic arterial hypertension, diabetes mellitus and restless legs syndrome) were obtained. Systemic arterial hypertension was defined as a systolic blood pressure of 140 mm/Hg or higher or a diastolic blood pressure of 90 mm/Hg or higher, or regular use of antihypertensive medication. Diabetes mellitus was defined as a fasting blood glucose concentration of 126 mg/dl or higher or current use of antidiabetic medication. Restless legs syndrome was defined based on International Restless Legs Syndrome Study Group consensus criteria[17].

The clinical characteristics of stroke; neurological impairment score on the National Institutes of Health Stroke Scale (NIHSS); etiologic classification according Trial of Org 10172 in Acute Stroke Treatment (TOAST), validated in Brazil; and evaluation of the degree of disability according to the modified Rankin Scale (mRS) were noted[18,19,20].

All patients answered the PSQI and STOP-BANG questionnaires, validated in Brazil[14,15,21,22,23,24].

Statistical analysis

Data analysis was performed using the SPSS 15.0 (Statistical Package for Social Science Software), considering a significance level of less than 5% for all statistical tests.

Data were expressed as mean and standard deviation: age, BMI, NIHSS, mRS, STOP-BANG, and PSQI. We determined the prevalence of arterial hypertension, diabetes mellitus, current smoking, restless legs syndrome, complaint of pain and poor quality of sleep in this population. The prevalence of ischemic and hemorrhagic strokes, as well as the classification of ischemic strokes was made according the TOAST criteria.

The Mann-Whitney test was used to compare good sleepers (PSQI ≤ 5) and poor sleepers (PSQI > 5). Logistic regression analysis was applied considering the STOP-BANG score as an independent variable and sleep quality measured by the PSQI as the dependent variable, controlled for age and sex.

RESULTS

The mean age was 59.8 ± 12.9 years, 51.5% were male, the BMI was 26.5 ± 5.1 kg/m^2, with the interview done within 163 ± 141 days after stroke. We observed a low average NIHSS score (2.8 ± 2.1) and degree of disability as measured by the mRS (1.5 ± 1.1). The prevalence of hypertension, diabetes mellitus and smoking were 83.8%, 35.3% and 22.1%, respectively. Of the 68 patients, 50 (73.5%) complained of pain, only nine (13.2%) filled the diagnostic

criteria for restless legs syndrome, and 48 (70.6%) had poor sleep quality (Table 1).

Sixty-four (94.1%) patients had ischemic stroke and four (5.9%) had hemorrhagic stroke. The TOAST etiology classified the strokes as occlusion of small vessels (32.8%), inconclusive (26.6%), large artery atherosclerosis (18.8%), cardioembolic (15.6%), and other causes (6.3%).

The STOP-BANG and PSQI scores were 4.3 ± 1.8 and 7.6 ± 3.9, respectively. Good sleepers (PSQI ≤ 5) were compared with poor sleepers (PSQI > 5). No significant differences were seen between good or poor sleepers for sex, presence of hypertension, diabetes mellitus, smoking, restless legs syndrome or the etiologic classification of stroke by TOAST. The STOP-BANG scores were higher in poor sleepers than good sleepers (4.5 ± 1.6 versus 3.5 ± 1.9; p = 0.032).

Logistic regression analysis was used to identify predictors of subjective sleep quality (PSQI score) making the STOP-BANG a predictor of a poor-quality sleep, at p < 0.05 and relative risk of 1.6, controlled for age and sex (Table 2).

DISCUSSION

We found that the STOP-BANG score worked as a predictor of a poor quality of sleep with a relative risk of 1.6, reflecting the impact of nighttime breathing problems on the sleep quality of post-stroke patients.

Table 1. Demographic data and characteristics.

Parameter	Sample (n = 68)
Age (years)	59.8 ± 12.9
Male	35 (51.5%)
Body-mass index (kg/m^2)	26.5 ± 5.1
Hypertension*	57 (83.8%)
Diabetes**	24 (35.3%)
Current smoker	15 (22.1%)
Restless legs syndrome	9 (13.2%)
Pain complaint	50 (73.5%)
NIHSS	2.8 ± 2.1
Mrs	1.5 (1.1)
STOP-BANG	4.3 ± 1.8
STOP-BANG ≥ 3	57 (83.8%)
PSQI	7.6 ± 3.9
Bad sleepers (PSQI ≥ 6)	48 (70.6%)

Data are mean (SD) or n (%). *Defined as a systolic blood pressure of 140 mm Hg or higher or a diastolic blood pressure of 90 mm Hg or higher, or current use of antihypertensive medication; **Defined as a fasting blood glucose concentration of 126 mg/dl or higher or current use of antidiabetic medication; NIHSS: National Institutes of Health Stroke Scale; mRS: Modified Rankin Scale; PSQI: Pittsburgh Sleep Quality Index.

Quality of sleep is an important issue in stroke patients. Complaints of insomnia and increased sleep latency have been identified as predictors of a poor quality of sleep in patients after stroke[2]. Interestingly, self-reported questionnaires were better as predictors of sleep quality than sleep studies in patients with obstructive sleep apnea[25].

The identification and treatment of predictors of poor sleep quality after stroke is very important, due to the potential impact on the patient's quality of life. According to the PSQI, 70.6% of our patients were considered poor sleepers (7.6 ± 3.9 points).

On the other hand, the sensitivity of the STOP-BANG questionnaire (three or more affirmative answers) for obstructive sleep apnea detection was 83.6%. This confirms that our patients had a higher risk of nocturnal breathing complaints after stroke. In fact, the higher scores of the STOP-BANG in poor sleepers (4.5 ± 1.6) compared with good sleepers (3.5 ± 1.9) indicate the large influence of nocturnal breathing problems on the quality of sleep after stroke in our cohort.

In contrast to the PSQI, the STOP-BANG is a practical tool: it is short, has an easy-to-remember mnemonic and a simple calculable scoring system. Furthermore, patients have relatively little difficulty in answering it, giving a high overall response rate[26]. The identification of impaired sleep quality and frequency of sleep disturbances in patients with stroke can lead to corrective measures, such as the establishment of proper routines and habits, as well as more appropriate time for therapeutic interventions[27,28].

We are unaware of previous studies addressing the impact of nighttime respiratory problems measured by the STOP-BANG questionnaire in the sleep quality of patients after stroke. However, a few limitations must be highlighted. The characteristics of sleep analyzed were determined exclusively by self-reported data, without confirmation through complementary tests. In addition, we included both ischemic and hemorrhagic stroke patients, although they have different pathophysiological mechanisms[29].

This study indicates that sleep quality was greatly influenced by sleep-related breathing problems, which were well identified by the STOP-BANG questionnaire, especially in younger stroke patients.

Table 2. Logistic regression analysis considering the STOP-BANG scores as an independent variable and sleep quality measured by the Pittsburgh Sleep Quality Index as the dependent variable, controlled for age and sex.

Variables	Beta coefficient	RR	95%CI	p
STOP-BANG (each score)	0.478	1.61	1.03–2.51	0.035
Age (each year)	-0.023	0.98	0.93–1.02	0.340
Male sex	0.821	2.27	0.50–10.20	0.284

References

1. Coca A, Messerli FH, Benetos A, Zhou Q, Champion A, Cooper-DeHoff RM et al. Predicting stroke risk in hypertensive patients with coronary artery disease: a report from the INVEST. Stroke. 2008;39(2):343-8. https://doi.org/10.1161/STROKEAHA.107.495465
2. Da Rocha PC, Barroso MT, Dantas AA, Melo LP, Campos TF. Predictive factors of subjective sleep quality and insomnia complaint in patients with stroke: implications for clinical practice. An Acad Bras Cienc. 2013;85(3):1197-206. https://doi.org/10.1590/S0001-37652013005000053
3. Ma VY, Chan L, Carruthers KJ. Incidence, prevalence, costs, and impact on disability of common conditions requiring rehabilitation in the United States: stroke, spinal cord injury, traumatic brain injury, multiple sclerosis, osteoarthritis, rheumatoid arthritis, limb loss, and back pain. Arch Phys Med Rehabil. 2014;95(5):986-95.e1. https://doi.org/10.1016/j.apmr.2013.10.032
4. Yaggi HK, Concato J, Kernan WN, Lichtman JH, Brass LM, Mohsenin V. Obstructive sleep apnea as a risk factor for stroke and death. N Engl J Med. 2005;353(19):2034-41. https://doi.org/10.1056/NEJMoa043104
5. St-Onge MP, Grandner MA, Brown D, Conroy MB, Jean-Louis G, Coons M et al. Sleep duration and quality: impact on lifestyle behaviors and cardiometabolic health: a scientific statement from the American Heart Association. Circulation. 2016;134(18):e367-86. https://doi.org/10.1161/CIR.0000000000000444
6. Mohsenin V, Culebras A. Sleep-related breathing disorders and risk of stroke. Stroke. 2001;32(6):1271-8. https://doi.org/10.1161/01.STR.32.6.1271
7. Pasic Z, Smajlovic D, Dostovic Z, Kojic B, Selmanovic S. Incidence and types of sleep disorders in patients with stroke. Med Arh. 2011;65(4):225-7. https://doi.org/10.5455/medarh.2011.65.225-227
8. Suh M, Choi-Kwon S, Kim JS. Sleep disturbances after cerebral infarction: role of depression and fatigue. J Stroke Cerebrovasc Dis. 2014;23(7):1949-55. https://doi.org/10.1016/j.jstrokecerebrovasdis.2014.01.029
9. Hermann DM, Siccoli M, Brugger P, Wachter K, Mathis J, Achermann P et al. Evolution of neurological, neuropsychological and sleep-wake disturbances after paramedian thalamic stroke. Stroke. 2008;39(1):62-8. https://doi.org/10.1161/STROKEAHA.107.494955
10. Young T, Peppard PE, Gottlieb DJ. Epidemiology of obstructive sleep apnea: a population health perspective. Am J Respir Crit Care Med. 2002;165(9):1217-39. https://doi.org/10.1164/rccm.2109080
11. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med. 1993;328(17):1230-5. https://doi.org/10.1056/NEJM199304293281704
12. Hermann DM, Bassetti CL. Role of sleep-disordered breathing and sleep-wake disturbances for stroke and stroke recovery. Neurology. 2016;87(13):1407-16. https://doi.org/10.1212/WNL.0000000000003037
13. Wright KP Jr, Hull JT, Hughes RJ, Ronda JM, Czeisler CA. Sleep and wakefulness out of phase with internal biological time impairs learning in humans. J Cogn Neurosci. 2006;18(4):508-21. https://doi.org/10.1162/jocn.2006.18.4.508
14. Marti-Soler H, Hirotsu C, Marques-Vidal P, Vollenweider P, Waeber G, Preisig M et al. The NoSAS score for screening of sleep-disordered breathing: a derivation and validation study. Lancet Respir Med. 2016;4(9):742-8. https://doi.org/10.1016/S2213-2600(16)30075-3
15. Coelho FM, Pradella-Hallinan M, Palombini L, Tufik S, Bittencourt LR. The STOP-BANG questionnaire was a useful tool to identify OSA during epidemiological study in São Paulo (Brazil). Sleep Med. 2012;13(4):450-1. https://doi.org/10.1016/j.sleep.2012.01.008
16. Kojic B, Burina A, Sinanovic O. One year outcome of acute stroke patients with sleep apnea. Med Arch. 2015;69(3):149-52. https://doi.org/10.5455/medarh.2015.69.149-152
17. Allen RP, Picchietti DL, Garcia-Borreguero D, Ondo WG, Walters AS, Winkelman JW et al. Restless legs syndrome/Willis-Ekbom disease diagnostic criteria: updated International Restless Legs Syndrome Study Group (IRLSSG) consensus criteria: history, rationale, description, and significance. Sleep Med. 2014;15(8):860-73. https://doi.org/10.1016/j.sleep.2014.03.025
18. Caneda MA, Fernandes JG, de Almeida AG, Mugnol FE. [Reliability of neurological assessment scales in patients with stroke]. Arq Neuropsiquiatr. 2006;64(3A):690-7. Portuguese. https://doi.org/10.1590/S0004-282X2006000400034
19. Adams HP Jr, Bendixen BH, Kappelle LJ, Biller J, Love BB, Gordon DL et al. Classification of subtype of acute ischemic stroke. Definitions for use in a multicenter clinical trial. TOAST. Trial of Org 10172 in Acute Stroke Treatment. Stroke. 1993;24(1):35-41. https://doi.org/10.1161/01.STR.24.1.35
20. Cincura C, Pontes-Neto OM, Neville IS, Mendes HF, Menezes DF, Mariano DC et al. Validation of the National Institutes of Health Stroke Scale, modified Rankin Scale and Barthel Index in Brazil: the role of cultural adaptation and structured interviewing. Cerebrovasc Dis. 2009;27(2):119-22. https://doi.org/10.1159/000177918
21. Douglass AB, Bornstein R, Nino-Murcia G, Keenan S, Miles L, Zarcone VP Jr et al. The Sleep Disorders Questionnaire. I: creation and multivariate structure of SDQ. Sleep. 1994;17(2):160-7. https://doi.org/10.1093/sleep/17.2.160
22. Reis R, Teixeira F, Martins V, Sousa L, Batata L, Santos C et al. Validation of a Portuguese version of the STOP-Bang questionnaire as a screening tool for obstructive sleep apnea: analysis in a sleep clinic. Rev Port Pneumol (2006). 2015;21(2):61-8. https://doi.org/10.1016/j.rppnen.2014.04.009
23. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193-213. https://doi.org/10.1016/0165-1781(89)90047-4
24. Bertolazi AN, Fagondes SC, Hoff LS, Dartora EG, Miozzo IC, de Barba ME et al. Validation of the Brazilian Portuguese version of the Pittsburgh Sleep Quality Index. Sleep Med. 2011;12(1):70-5. https://doi.org/10.1016/j.sleep.2010.04.020
25. Wells RD, Day RC, Carney RM, Freedland KE, Duntley SP. Depression predicts self-reported sleep quality in patients with obstructive sleep apnea. Psychosom Med. 2004;66(5):692-7. https://doi.org/10.1097/01.psy.0000140002.84288.e1
26. Boynton G, Vahabzadeh A, Hammoud S, Ruzicka DL, Chervin RD. Validation of the STOP-BANG Questionnaire among patients referred for suspected obstructive sleep apnea. J Sleep Disord Treat Care. 2013;2(4). https://doi.org/10.4172/2325-9639.1000121
27. Chung F, Yegneswaran B, Liao P, Chung SA, Vairavanathan S, Islam S et al. STOP questionnaire: a tool to screen patients for obstructive sleep apnea. Anesthesiology. 2008;108(5):812-21. https://doi.org/10.1097/ALN.0b013e31816d83e4
28. Chung F, Subramanyam R, Liao P, Sasaki E, Shapiro C, Sun Y. High STOP-Bang score indicates a high probability of obstructive sleep apnoea. Br J Anaesth. 2012;108(5):768-75. https://doi.org/10.1093/bja/aes022
29. Westerlund A, Lagerros YT, Kecklund G, Axelsson J, Åkerstedt T. Relationships Between Questionnaire Ratings of Sleep Quality and Polysomnography in Healthy Adults. Behav Sleep Med. 2016;14(2):185-99. https://doi.org/10.1080/15402002.2014.974181