



Original Article

Agreement between stroke patients and family members for ascertaining pre-stroke risk for sleep apnea



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ABSTRACT

Background: Ascertaining self-reported information about the risk for pre-stroke obstructive sleep apnea (OSA) in the acute stroke period is challenging as many stroke patients have deficits that hinder communication. We examined agreement between stroke patients without communication limitations and family members (proxy) in the pre-stroke risk for OSA.

Methods: Patient-proxy pairs ($n = 42$) were interviewed independently as part of the Brain Attack Surveillance in Corpus Christi (BASIC) Project from May 2010 to April 2011. The Berlin questionnaire was used to measure a high risk for OSA defined as the presence of at least two of the following conditions: (1) snoring behaviors/witnessed apneas, (2) daytime sleepiness, and (3) hypertension or obesity. Patient-proxy agreement was assessed using a κ coefficient.

Results: Forty-three percent of patients self-identified as being at high risk for sleep apnea, and 45% of proxies identified patients as high risk. Patient-proxy agreement for high risk for pre-stroke OSA was fair ($\kappa = 0.28$) with better agreement for spouses and children proxies ($\kappa = 0.38$) than for other family members. Agreement also was fair for most individual questions.

Conclusions: Spouse and child proxy use of the Berlin questionnaire may be an option to assess a patient's pre-stroke likelihood of sleep apnea. Whereas prospective studies of incident stroke in patients with and without objectively confirmed sleep apnea would require formidable resources, our results suggest that an alternative strategy may involve proxy use of the Berlin questionnaire in a retrospective study design.

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1. Introduction

Obstructive sleep apnea (OSA) is a risk factor for ischemic stroke [1,2]. OSA also affects stroke outcomes, as it is associated with greater risk for death and disability among stroke patients [3,4]. Although OSA is an emerging risk factor for stroke occurrence and poor stroke outcomes, few large-scale stroke studies have investigated the implications of preexisting OSA in regard to after stroke treatment, screening priorities and their cost-effectiveness, and stroke prevention strategies.

Assessment of OSA is important to begin to answer questions regarding the emerging relationship between OSA and stroke. The most accurate assessment of OSA is through use of polysomnography (PSG); however, PSG is a procedure involving expensive equipment, trained technicians, and overnight assessment of sleep habits [5,6]. Following a prospective cohort of individuals tested by

PSG for stroke is challenging considering the number of subjects who would need to be followed and the financial and administrative challenges of administering PSG to all subjects over time to update their OSA status. Because PSG is not routinely performed, after stroke assessments may be the most feasible estimate of pre-stroke OSA available. The Berlin sleep questionnaire may be a practical solution for assessing the pre-stroke risk for OSA in the acute stroke period [7,8].

Assessment of pre-stroke OSA in the acute stroke period via questionnaires such as the Berlin questionnaire is not without challenges, as at least 25% of stroke survivors have communication deficits [9]. Proxies such as spouses or children may be another option to assess risk for sleep apnea using the Berlin questionnaire; however, the reliability between stroke patient and proxy responses regarding pre-stroke sleep apnea is unknown. Our study examined the agreement between stroke patients without communication limitations and family member (proxy) assessment for pre-stroke risk for sleep apnea using the Berlin questionnaire. We hypothesized that agreement would be adequate.

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2. Methods

Stroke patients were identified through the Brain Attack Surveillance in Corpus Christi (BASIC) Project. The methods of the BASIC project have been previously described [10,11]. Briefly, stroke cases from Nueces County, TX were identified from all hospitals in the county and validated by neurologists. A convenience sample of ischemic stroke patients ascertained from May 2010 to April 2011 were included in our analysis. Proxies were identified by patients as a family member or close friend who would know the patients best and patient–proxy pairs were interviewed in-person or by phone, independently from one another to ascertain information related to the patient's pre-stroke sleep apnea symptoms.

The Berlin questionnaire was used to assess high risk for sleep apnea (yes vs no) as defined by the presence of at least two of the following conditions: (1) snoring behaviors and witnessed apneas (5 scored questions), (2) daytime sleepiness (3 scored questions), and (3) presence of hypertension or obesity (2 scored questions) [7]. Snoring behaviors and witnessed apneas were considered present if the patient stopped breathing at least three times a week during sleep or had two or more of the following symptoms: snoring, loud or very loud snoring, snoring at least three nights a week, or that snoring bothers others. Daytime sleepiness was defined as ever falling asleep while driving or as having at least two of the following symptoms at least three days a week: feeling tired or fatigued after sleep or feeling tired or fatigued during wake time [12].

Hypertension status was abstracted from the patient's medical records and both proxies and patients reported on patient's height and weight to determine body mass index (BMI). A BMI of greater than 30 was used to define obesity.

Patients and proxies reported age, race/ethnicity, sex and level of education (high school education vs no high school education). Additionally, proxies were asked about their relationship with the patient, including speaking frequency and years they had known the patient. The National Institutes of Health Stroke Scale (NIHSS) for the patient was determined by retrospective chart abstraction using a previously validated method [13].

Our study was approved by the University of Michigan institutional review board and by the institutional review boards of the two hospital systems in Corpus Christi.

2.1. Statistical analysis

Means and standard deviations (SD) were computed for age, NIHSS score, and years of patient–proxy relationship. Frequencies and percentages were computed for race/ethnicity, sex, level of education, patient–proxy relationship and speaking frequency, hypertension status, and BMI. Overall patient–proxy agreement for reporting high risk for sleep apnea pre-stroke was assessed using a κ statistic. Overall agreement also was stratified by proxy-patient relationship, defined as either spouse/child or other family member and by NIHSS score (above vs below median 134 score). Agreement for presence of snoring behaviors and presence of witnessed apneas, daytime sleepiness, and obesity also was explored. Among the snoring behaviors and witnessed apneas/daytime sleepiness, the patient–proxy agreement for each of the symptoms also was evaluated.

3. Results

A total of 42 patient–proxy pairs were interviewed an average of 19.9 days after stroke (median, 14 days; range, 3–76 d). The average patient age was 68 (SD, 12 years); 67% ($n = 28$) were Mexican American and 33% ($n = 14$) were non-Hispanic white. A similar

number of male (55%, $n = 23$) and female (45%, $n = 19$) patients participated, and the average NIHSS score on admission was 5.3 (SD, 6.3). The majority of patients were hypertensive (86%, $n = 36$), and 14% ($n = 6$) had a BMI greater than 30. Proxies were spouses (52%, $n = 22$), children (31%, $n = 13$), siblings (10%, $n = 4$), parents (5%, $n = 2$), or other family members (2%, $n = 1$). Proxies had known the patients for an average of 42 years (SD, 15) and spoke with the patient either daily (95%, $n = 40$) or weekly (5%, $n = 2$) (Table 1).

Based on the Berlin questionnaire results, 43% of patients self-identified as high risk for sleep apnea ($n = 18$) and 45% of proxies identified the patient as high risk ($n = 19$). Overall patient–proxy agreement for high risk for sleep apnea was fair ($\kappa = 0.28$) [14]. Agreement differed by patient relationship; spouse and child proxies ($\kappa = 0.38$ for both) had better agreement than other family members ($\kappa = 0.13$). Among eight pairs, patients identified themselves as low risk, whereas proxies identified them as high risk. Among seven pairs, patients identified themselves as high risk and proxies identified them as low risk (See Table 2).

Among patients, 15 (36%) classified themselves as having snoring behaviors and witnessed apneas, and 36% of proxies classified patients as having these characteristics ($\kappa = 0.27$). Agreement regarding the specific elements of this category was fair for loud or very loud snoring ($\kappa = 0.30$), snoring that bothered others ($\kappa = 0.31$), and cessation of breathing at least three times a week during sleep ($\kappa = 0.30$). Agreement in this category was poor for snoring at least three nights a week ($\kappa = 0.14$) (See Table 3).

Assessment of daytime sleepiness showed 26% of patients and 24% of proxies scoring the patient positive on at least two elements ($\kappa = 0.30$). Agreement was fair for being tired after sleep ($\kappa = 0.45$) and tired during wake time ($\kappa = 0.43$). No patients reported falling asleep while driving three or more times per week.

Assessment of obesity showed adequate agreement between patient and proxy, with a κ of 0.74 (Table 3).

4. Discussion

Overall, ischemic stroke patient–family member proxy agreement for high risk for sleep apnea measured by the Berlin questionnaire in reference to the pre-stroke period was fair, as was agreement on most individual question items. However, when stratified by relationship, agreement was higher for children and spouses than for other family members.

Previous studies have presented conflicting evidence regarding the use of the Berlin questionnaire among proxies to assess risk for sleep apnea. The Berlin questionnaire has shown poor correlation between bed partner assessments and PSG findings among acute stroke patients [15]; however, another study showed adequate sensitivity for proxy reports when compared to overnight PSG [16]. The latter study also compared the patient and bed partner responses on the Berlin questionnaire to the overnight PSG and found the bed partner assessment to be more accurate than the patient responses when compared to PSG. This finding could reflect that patients generally are less aware of their snoring and apnea habits during sleep than their bed partners. Our results among stroke patients reflect a similar pattern, with lowest agreement found among questions regarding snoring intensity and frequency; however, our study expands on previous findings by including additional family members besides bed partners as potential proxies and focusing on the pre-stroke period for OSA risk assessment. Additional validation studies are necessary to understand the best approach for using proxy responses for the assessment of OSA among stroke patients, particularly given the prevalence of communication deficits among stroke patients.

Several limitations must be considered when interpreting these results. As discussed, the Berlin questionnaire is not the gold

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