HHS Public Access

Author manuscript

Sleep Med. Author manuscript; available in PMC 2020 July 01.

Published in final edited form as:

Sleep Med. 2019 July ; 59: 90–93. doi:10.1016/j.sleep.2018.09.009.

Sleep apnea screening is uncommon after stroke

Devin L. Brown, MD, MS[1], **Xiaqing Jiang, MPH**[2], **Chengwei Li, MPH**[1,2], **Erin Case, BA**[1,2], **Cemal B. Sozener, MD**[1,3], **Ronald D. Chervin, MD, MS**[4], and **Lynda D. Lisabeth, PhD**[1,2]

[1]Stroke Program, University of Michigan

[2]Department of Epidemiology, School of Public Health, University of Michigan

[3]Department of Emergency Medicine, University of Michigan

[4]Sleep Disorders Center and Department of Neurology, University of Michigan

Abstract

Objective/Background: To assess (1) pre and post-stroke screening for sleep apnea (SA) within a population-based study without an academic medical center, and (2) ethnic differences in poststroke sleep apnea screening among Mexican Americans (MAs) and non-Hispanic whites (NHWs).

Patients/Methods: MAs and NHWs with stroke in the Brain Attack Surveillance in Corpus Christi project (2011–2015) were interviewed shortly after stroke about the pre-stroke period, and again at approximately 90 days after stroke in reference to the post-stroke period. Questions included whether any clinical provider directly asked about snoring or daytime sleepiness or had offered polysomnography. Logistic regression tested the association between these outcomes and ethnicity both unadjusted and adjusted for potential confounders.

Results: Among 981 participants, 63% were MA. MAs in comparison to NHWs were younger, had a higher prevalence of hypertension, diabetes, and never smoking, a higher body mass index, and a lower prevalence of atrial fibrillation. Only 17% reported having been offered SA diagnostic testing pre-stroke, without a difference by ethnicity. In the post-stroke period, only 50 (5%) participants reported being directly queried about snoring; 86 (9%) reported being directly queried about sleepiness; and 55 (6%) reported having been offered polysomnography. No ethnic differences were found for these three outcomes, in unadjusted or adjusted analyses.

Conclusions: Screening for classic symptoms of SA, and formal testing for SA, are rare within the first 90 days after stroke, for both MAs and NHWs. Provider education is needed to raise awareness that SA affects most patients after stroke and is associated with poor outcomes.

Keywords

Sleep apnea; Cerebrovascular disease/Stroke

Correspondence : Devin L. Brown, MD, MS, 1500 East Medical Center Drive, Ann Arbor, Michigan, 48109-5855 , Phone (734) 936-9075, Fax (734) 232-4447, devinb@umich.edu.

Introduction

Sleep apnea (SA) affects the majority of post-stroke patients[1] and is associated with poor stroke outcomes.[2] SA is also an established independent risk factor for stroke.[3] Yet limited data are available about screening of stroke patients for SA. A 2014 American Heart/Stroke Association guideline suggested consideration of a sleep study for patients with ischemic stroke/TIA based on the high prevalence of SA and evidence that treatment of SA in the general SA population improves non-stroke-related outcomes.[4] Results that predate these recommendations suggest that screening for SA among stroke patients is uncommon.[5]

Mexican Americans (MAs), the largest subgroup of Hispanic Americans, who themselves are the largest minority group in the United States, have in comparison to non-Hispanic whites (NHWs) a higher risk of ischemic stroke[6] and a higher prevalence of post-stroke SA.[1] A better understanding of barriers to healthcare for SA among MAs with stroke could inform interventions to decrease the stroke-related burden in this growing segment of the population. We therefore investigated use of SA screening for post-stroke patients, in consideration of interventions that may improve stroke care for all patients and specifically health outcomes for MAs.

Materials and Methods

Detailed methods of the Brain Attack Surveillance in Corpus Christi Project have been previously published.[6] Both active and passive surveillance are used to identify all cases of ischemic stroke and intracerebral hemorrhage (ICH) in all acute care hospitals in Nueces County, Texas among county residents. Study physicians, masked to age and ethnicity, validate cases using source documentation. A baseline interview conducted with the patient or a proxy is conducted at the time of enrollment or shortly after, and a follow-up interview is conducted around 90 days post-stroke. From 2011–2015, participants were queried about (1) their report of any symptom of sleep apnea to their health care provider (e.g. excessive daytime somnolence, snoring, witnessed apneas, gasping during sleep, excessive sweating during sleep), (2) whether they had been directly asked by a health care provider about any of these symptoms, (3) if they were offered polysomnography by any provider and whether it had been performed. The 90-day interview referenced the entire post-stroke period and the baseline interview referenced the entire pre-stroke period. Only MAs and NHWs were considered for this analysis as other race/ethnicities were too few to be included in racial/ethnic comparisons. The study was approved by the Institutional Review Boards at the University of Michigan and the two Corpus Christi hospital systems. Written informed consent was provided by patients or surrogate.

Statistical analysis:

Ethnic comparisons were made by Chi square tests (or Fisher's exact tests) or t-tests as appropriate. Logistic regression was used to test the association between ethnicity and the outcomes of interest. The 90-day interview data were of primary interest and the three coprimary outcomes were query by physician about excessive daytime sleepiness, query by physician about snoring, and referral by physician for SA testing. Models were run

unadjusted and adjusted for multiple potential confounders. Finally, we assessed for a possible temporal trend in referral by a provider for SA testing at the 90-day time point, unadjusted, in both ethnicities combined, with logistic regression (year modeled continuously). In all analyses, $p<0.05$ was considered significant and no adjustment was made for multiple comparisons.

Results

At baseline, 1,532 subjects completed the interview. Of these, 1,301 were alive at the 90-day time point, of which 981 (75%) completed the 90-day interview; 617 (63%) were MA and the remainder were NHW. Most (89%) had ischemic strokes. Ethnic comparisons are found in Table A.1. MAs in comparison to NHWs were younger, had higher average BMI, and had a greater prevalence of hypertension and diabetes, and lower prevalence of smoking and atrial fibrillation.

Post-stroke:

By 90-days post-stroke, participants reported symptoms of SA to their health care providers infrequently; the frequency ranged from 3–14% across symptoms (Table). Only reports of gasping differed by ethnicity, with a higher frequency among MAs than NHWs (p=0.02). Participants were asked about SA symptoms directly by a health care provider infrequently, ranging from 3–9% across symptoms, with no ethnic differences. Only 6% were offered SA diagnostic testing in the post-stroke period, with no ethnic difference (Table). By year, this frequency was as follows: 9% (2011), 7% (2012), 5% (2013), 5% (2014), 4% (2015), with a nonsignificant decreasing trend (p=0.13). Actual SA test completion, according to participants, was only 2%, with no ethnic difference (Table). No ethnic differences were identified in the multivariable models (Table A.2).

Pre-stroke:

In the pre-stroke period, participants reported symptoms of SA to their health care providers in the pre-stroke period only infrequently. The frequency ranged from 6–12% across specific symptoms (Table); none differed by ethnicity. Participants were asked about SA symptoms directly by a health care provider infrequently; the frequency ranged from 3–9% across symptoms. MAs in comparison to NHWs reported having been asked more frequently about sweating during sleep (p=0.04), with no other ethnic differences noted. Only 17% were offered SA diagnostic testing, with no ethnic difference. Approximately 14% reported completion of testing. In the multivariable models, MAs in comparison to NHWs were less likely to have been offered SA diagnostic testing in the pre-stroke period (OR: 0.71 (95% CI: 0.53–0.96)) after adjustment for multiple potential confounders (Table A.2). No other ethnic differences were identified after adjustment (Table A.2).

Discussion

This population-based study of almost 1,000 patients suggests that symptom-based screening for SA is distinctly uncommon within the 3 months after stroke. Roughly 5% were offered formal sleep tests, and 2% had tests during that period, despite the known

epidemiology and importance of post-stroke SA. This low frequency of testing does not seem to be explained by a high prestroke testing frequency, which also was found to be low, or by diligent screening of SA symptoms by physicians, albeit symptom screening even by way of validated questionnaire does not have a high predictive value in post-stroke patients.[7] Despite publication of a national guideline statement that included recommendations about SA testing in stroke patients,[4] no temporal trend was identified in offers to patients for SA testing. Moreover, nominally, offer frequency was lower in the years after rather than before the published guideline. Despite the very high prevalence of post-stroke SA -- and therefore potential public health impact of SA treatment in this population should trials show efficacy -- the current results suggest that screening for post-stroke SA has not yet become part of routine standard of care. Reasons for the low prevalence of screening are unclear, but do not appear to be largely patient-driven given the low frequency of physician offers for testing. Physicians may lack awareness of the high prevalence of post-stroke SA, or its associations with outcomes. Interventions to raise physician knowledge related to SA in stroke may be needed. However, physicians also may lack motivation to test for SA given that stroke-specific benefits of SA treatment have yet to be proven. The Sleep for Stroke Management and Recovery Trial (Sleep SMART), recently funded by the NIH, may help resolve this uncertainty.

Our results suggest that specific testing for SA in the immediate post-stroke period is quite uncommon. If assessment for SA is desired, physiological testing for SA in post-stroke patients is needed given the inadequate performance of questionnaire-based assessments.[7] Our finding from the patient perspective differs notably from the results of a 2007 random sample of neurologist members of the American Academy of Neurology.[8] Seventy-nine percent of the 324 general neurologist respondents and 94% of the 62 vascular neurologist respondents indicated that after a recent hospitalization for ischemic stroke or TIA, they do screen patients for obstructive sleep apnea in the outpatient setting. However, in this survey, “seldom” was collapsed into the screen category suggesting that the results may be inflated.

Sleep apnea is an important independent risk factor for stroke,[3;9] yet screening for SA among these stroke patients in the pre-stroke period, when they were at high risk for stroke and had a high prevalence of stroke risk factors (Table 1) was uncommon. Furthermore, MAs were less likely to be offered formal testing of SA, after adjustment for potential confounders, a newly discovered health disparity. SA has been found to be grossly underdiagnosed in the general Hispanic population, with only 1.3% in a recent study having reported a physician diagnosis of SA despite a high prevalence when tested.[10] The current results highlight the need to increase screening for SA in MAs at risk for stroke.

In our study, information was self-reported by patients and thus subject to recall bias. However, interviews of patients provide a comprehensive overview of all offers for SA testing for an individual patient. Interviews of providers would have provided complementary information including the reasons for lack of screening, but inquiry of every provider for a given patient would not have been feasible. We did not seek information on pre-existing diagnosis of SA, although this is uncommon among stroke patients. We did not specifically inquire about home sleep apnea test application. However, use of home sleep apnea tests, although more feasible and more frequently used for post-stroke SA research

than polysomnography, has been discouraged by the American Academy of Sleep Medicine for stroke patients in favor of polysomnography,[11] and patients are unlikely to have distinguished between the two. The results of this study may not be representative of practice in tertiary care centers or generalizable to all communities.

Conclusions

Despite the well-established high prevalence of post-stroke SA, known association with poor post-stroke outcomes, and implications for risk stratification, screening for post-stroke SA has not yet become part of routine standard of care based on this large population-based study. Definitive clinical trials are needed to determine the effects of SA treatment on post-stroke outcomes, as this will also further inform the role of screening. Provider education about screening for SA in patients at high risk for stroke, especially MAs, is also needed to improve patient care and redress a newly identified health disparity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgment

This study was performed in the Corpus Christi Medical Center and CHRISTUS Spohn hospitals, CHRISTUS Health system, in Corpus Christi, Texas.

Sources of funding

The project was funded by R01 NS070941. The funding source played no role in the decision to submit this analysis for consideration or in the interpretation of data.

Disclosures

Brown: received funding from R01HL126700, R01HL123379, R01 NS070941, R01 HL098065, and has received travel support from the American Academy of Sleep Medicine and the Mayo Clinic.

Jiang: has received funding from R01NS038916 and R01 NS070941

Li: has received funding from U10 NS086526, R01 NS070941, R01NS091112, R01HL126700.

Case: has received funding from R01NS091112, R01 NS070941, R01NS038916, R01HL126700

Sozener: has received funding from U01 NS069498.

Chervin: received research grant funding from the NIH. He has consulted for Zansors; serves as an editor and author for UpToDate; edited a book published by Cambridge University Press; and has produced copyrighted material, patents, and patents pending, owned by the University of Michigan, focused on assessment or treatment of sleep disorders. He has served on the Boards of Directors for the American Academy of Sleep Medicine, Associated Professional Sleep Societies, International Pediatric Sleep Association, and the non-profit Sweet Dreamzzz.

Lisabeth: received funding from R01NS038916, R01HL126700, R01HL123379, R01 NS070941, R01 HL098065

Table.

Stroke patient report of: 1) sleep apnea symptoms to their health care provider, 2) whether their health care provider asked about sleep apnea symptoms, 3) whether they were offered polysomnography by any provider, and 4) whether polysomnography performed.

Pre-stroke		Race/Ethnicity				All (N=1,532)		p value (from χ^2 tests)
		NHW (N=583)		MA (N=949)				
		N	Percent	N	Percent	N	Percent	
Self-report of specified sleep symptoms	Very sleepy during the day	67	11.49	114	12.01	181	11.81	0.7614
	Snoring	63	10.80	98	10.32	161	10.50	0.7644
	Stopped breathing	38	6.51	70	7.37	108	7.04	0.5254
	Gasping for air	32	5.48	67	7.06	99	6.46	0.2253
	Sweating a lot	40	6.86	74	7.79	114	7.44	0.499
Provider asked about symptoms	Very sleepy during the day	45	7.71	85	8.95	130	8.48	0.3998
	Snoring	55	9.43	82	8.64	137	8.94	0.5957
	Stopped breathing	37	6.34	65	6.84	102	6.65	0.703
	Gasping for air	28	4.80	64	6.74	92	6.00	0.1209
	Sweating a lot	20	3.43	55	5.79	75	4.89	**0.0374**
Provider offered sleep test		107	18.35	161	16.96	268	17.49	0.4875
Test completed		81	13.89	119	12.54	200	13.05	0.4450

Post-stroke		Race/Ethnicity				All (N=981)		p value (from χ^2 tests)
		NHW (N=364)		MA (N=617)				
		N	Percent	N	Percent	N	Percent	
Self-report of specified sleep symptoms	Very sleepy during the day	39	10.71	94	15.23	133	13.55	0.0457
	Snoring	17	4.67	26	4.21	43	4.38	0.7359
	Stopped breathing	8	2.19	17	2.75	25	2.54	0.5925
	Gasping for air	6	1.64	28	4.53	34	3.46	**0.0168**
	Sweating a lot	12	3.29	22	3.56	34	3.46	0.824
Provider asked about symptoms	Very sleepy during the day	26	7.14	60	9.72	86	8.76	0.1672
	Snoring	20	5.49	30	4.86	50	5.09	0.6636
	Stopped breathing	18	4.94	21	3.40	39	3.97	0.2326
	Gasping for air	19	5.21	23	3.72	42	4.28	0.2648
	Sweating a lot	13	3.57	14	2.26	27	2.75	0.2284
Provider offered sleep test		20	5.49	35	5.67	55	5.60	0.9067
Test completed		8	2.20	14	2.27	22	2.24	0.9420

Reference List

1. Lisabeth LD, Sánchez BN, Chervin RD et al. High Prevalence of Post-stroke Sleep Disordered Breathing in Mexican Americans. Sleep Med 2017; 33:97–102. [PubMed: 28449915]
2. Turkington PM, Allgar V, Bamford J, Wanklyn P, Elliott MW. Effect of upper airway obstruction in acute stroke on functional outcome at 6 months. Thorax 2004; 59:367–371. [PubMed: 15115859]

3. Loke YK, Brown JW, Kwok CS, Niruban A, Myint PK. Association of obstructive sleep apnea with risk of serious cardiovascular events: a systematic review and meta-analysis. Circ Cardiovasc Qual Outcomes 2012; 5:720–728. [PubMed: 22828826]

4. Kernan WN, Ovbiagele B, Black HR et al. Guidelines for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke 2014; 45:2160–2236. [PubMed: 24788967]

5. Skolarus LE, Lisabeth LD, Morgenstern LB, Burgin W, Brown DL. Sleep Apnea Risk Among Mexican American and Non-Hispanic White Stroke Survivors. Stroke 2012; 43:1143–1145. [PubMed: 22156693]

6. Morgenstern LB, Smith MA, Sánchez BN et al. Persistent ischemic stroke disparities despite declining incidence in Mexican Americans. Ann Neurol 2013; 74:778–785. [PubMed: 23868398]

7. Sico JJ, Yaggi HK, Ofner S et al. Development, Validation, and Assessment of an Ischemic Stroke or Transient Ischemic Attack-Specific Prediction Tool for Obstructive Sleep Apnea. J Stroke Cerebrovasc Dis 2017; 26:1745–1754. [PubMed: 28416405]

8. Dong JY, Zhang YH, Qin LQ. Obstructive sleep apnea and cardiovascular risk: meta-analysis of prospective cohort studies. Atherosclerosis 2013; 229:489–495. [PubMed: 23684511]

9. Redline S, Sotres-Alvarez D, Loredo J et al. Sleep-disordered Breathing in Hispanic/Latino Individuals of Diverse Backgrounds. The Hispanic Community Health Study/Study of Latinos. Am J Respir Crit Care Med 2014; 189:335–344. [PubMed: 24392863]

10. Kapur VK, Auckley DH, Chowdhuri S et al. Clinical Practice Guideline for Diagnostic Testing for Adult Obstructive Sleep Apnea: An American Academy of Sleep Medicine Clinical Practice Guideline. J Clin Sleep Med 2017; 13:479–504. [PubMed: 28162150]

Highlights:

- Screening for classic symptoms of sleep apnea by physicians is rare after stroke.
- Offers by physicians for formal sleep apnea testing is rare after stroke.
- Sleep apnea testing is uncommonly performed after stroke.
- Screening for sleep apnea after stroke by way of symptom assessment and formal testing was not different for Mexican Americans and non-Hispanic whites.

Table A.1.

Descriptive statistics: baseline characteristics overall and by race/ethnicity among those who responded to the 90-day interview.

	Race/Ethnicity						
	NHW (N=364)		MA (N=617)		All (N=981)		p value (from χ^2 tests)
	N	%	N	%	N	%	
Sex (Male vs Female)							0.9966
Male	180	49.45	305	49.43	485	49.43	
Insured (Y vs N)							0.2875
Yes	324	89.01	536	86.87	860	87.66	
Hypertension (Y vs N)							**0.0004**
Yes	271	74.45	516	83.63	787	80.22	
Diabetes Mellitus (Y vs N)							**<.0001**
Yes	123	33.79	343	55.59	466	47.50	
Atrial Fibrillation (Y vs N)							**0.0039**
Yes	64	17.58	69	11.18	133	13.55	
High Cholesterol (Y vs N)							0.6435
Yes	178	48.90	310	50.24	488	49.74	
Smoking type							**0.0288**
Former	76	20.87	90	14.58	166	16.92	
Current	81	22.25	131	21.23	212	21.61	
Never	205	56.31	393	63.69	598	60.95	
Baseline PCP status							0.1335*
None	39	10.71	56	9.07	95	9.68	
Private Clinic	316	86.81	525	85.08	841	85.72	
Nursing Home Clinician	3	0.82	12	1.94	15	1.52	
Free/Low Cost Clinic	5	1.37	20	3.24	25	2.54	
90-day PCP status							0.0612*
None	3	0.82	7	1.13	10	1.01	
Private Clinic	279	76.64	450	72.93	729	74.31	

Nursing Home Clinician	57	15.65	85	13.77	142	14.47	
Free/Low Cost Clinic	22	6.04	68	11.02	90	9.17	
	NHW (N=364)		MA (N=617)		All (N=981)		
Continuous variables	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	P from t-test
Age	364	70.3 (12)	617	67.5 (12)	981	68.5 (12)	**0.0006**
Initial NIHSS	362	5.2 (6)	615	5.8 (6.3)	977	5.6 (6.3)	0.1538
BMI	364	28.4 (7)	617	30.1 (6.7)	981	29.4 (6.8)	**0.0001**

* Fisher's exact test

Table A.2.

Odds ratios summarizing ethnic comparison (Mexican Americans vs non-Hispanic whites): provider query of sleep apnea symptom and offer of polysomnography.

	Unadjusted model		Adjusted model *	
Pre-Stroke				
	N	OR (95% CI)	N	OR (95% CI)
Very sleepy during the day	1,535	1.18 (0.81–1.71)	1,523	1.03 (0.70–1.52)
Snoring	1,535	0.91 (0.63–1.30)	1,523	0.77 (0.53–1.12)
Stopped breathing	1,535	1.09 (0.71–1.65)	1,523	0.87 (0.57–1.37)
Gasping for air	1,535	1.43 (0.91–2.26)	1,523	1.24 (0.78–1.98)
Sweating a lot	1,535	1.73 (1.03–2.92)	1,523	1.46 (0.86–2.50)
Provider offered sleep test before stroke	1,532	0.91 (0.69–1.19)	1,521	0.71 (0.53–0.95)
Post-Stroke				
Very sleepy during the day	985	1.39 (0.86–2.25)	965	1.37 (0.82–2.28)
Snoring	985	0.87 (0.49–1.56)	965	0.81 (0.43–1.53)
Stopped breathing	985	0.67 (0.35–1.28)	965	0.65 (0.31–1.34)
Gasping for air	985	0.70 (0.38–1.30)	965	0.61 (0.31–1.22)
Sweating a lot	985	0.62 (0.29–1.34)	965	0.58 (0.25–1.36)
Provider offered sleep test by 90 days post stroke	981	1.03 (0.59–1.82)	961	0.94 (0.51–1.73)

* Age (continuous), gender, insurance status, primary care provider status (at baseline or 90-day for baseline or 90-day outcomes, respectively), and body mass index (continuous) were adjusted for in the logistic regression for baseline and 90-day outcomes, while logistic regressions for outcomes at 90-day were further adjusted for stroke type (ischemic vs ICH), NIH Stroke Scale score, hypertension, diabetes, atrial fibrillation, hyperlipidemia, current smoking status.