



The National Healthy Sleep Awareness Project involves a partnership between the American Academy of Sleep Medicine, Centers for Disease Control and Prevention, and Sleep Research Society. The long term goal of the project is to promote improved sleep health in the United States. The project will increase public awareness of the importance of healthy sleep. It also will promote the treatment and prevention of sleep disorders.

Stroke and Obstructive Sleep Apnea

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CASE

A 72 year old male with a past medical history of hypertension and obesity is admitted to the hospital after acute onset of right sided facial droop and difficulty lifting the right arm and leg. Physical examination confirmed right face, arm, and leg weakness and MRI revealed a lacunar infarct of the left internal capsule. The patient had an uneventful hospital and rehabilitation course with the exception of a nocturnal oxygen requirement not explained by any pulmonary pathology. He presented to your clinic 4 weeks later reporting that he's always been told he snored loudly but he sleeps just fine. In addition to right sided weakness, physical examination revealed a BMI of 34.7 kg/m², a neck circumference of 17.5 inches, and class 3 modified Mallampati.

DISCUSSION

Sleep-disordered breathing (SDB) is common among individuals who have experienced stroke or transient ischemic attack (TIA) with prevalence of approximately 70%.¹ Obstructive sleep apnea (OSA) makes up the vast majority of SDB in this patient group, although central sleep apnea (CSA) is also seen in a small percentage.¹ The similar prevalence of OSA in stroke and TIA patients² suggests that OSA is likely present prior to the stroke or TIA, as opposed to a direct result of neurological compromise.

Importantly, OSA can increase the risk of incident stroke or TIA. Meta-analysis of prospective cohort studies demonstrated an approximately two-fold increase in the odds of subsequent ischemic cerebrovascular events in those with OSA.³ OSA is an independent risk factor that persists despite control for other relevant vascular comorbidities³⁻⁷ including atrial fibrillation.³ Initially, the risk appeared isolated to men³; however, more recent work that targeted female populations confirms this finding in women.^{6,7} Greater risk is seen with higher degrees of OSA severity.^{8,9}

Conversely, treatment of OSA may ameliorate the risk of future stroke.⁶ However, randomized controlled trials to determine the effect of continuous positive airway pressure (CPAP) for primary prevention of stroke in OSA patients are limited and have reported negative results.^{10,11} Insufficient sample size and poor CPAP adherence noted during these studies may be the driving factor behind similar incident cardiovascular events in individuals randomized to CPAP compared to controls.^{10,11}

In patients who have already experienced stroke or TIA, treatment of OSA can improve outcomes; therefore rapid diagnosis is crucial. Symptoms suggestive of OSA in general also apply to this population and include: snoring, choking, gasping, witnessed apneas, poor sleep quality, excessive daytime sleepiness, and fatigue.¹² Clinical characteristics such as male gender, obesity, upper airway anatomy that may predispose to obstruction, atrial fibrillation, and hypertension should increase the index of suspicion.^{1,12-14} Features specific to stroke patients such as recurrent stroke and unknown etiology of stroke increase the likelihood of OSA.¹ In the acute inpatient setting, unexplained hypoxia may be the result of OSA.¹⁵ Given the poor predictive value of tools using signs and symptoms, suspected OSA must be confirmed by diagnostic testing. Especially given that stroke patients with OSA may not report excessive daytime sleepiness and are more likely to be female and non-obese.

Diagnostic testing may be conducted even in the acute post-stroke setting as soon as the patient is able to tolerate the evaluation and can be performed with polysomnogram (PSG) or split-night PSG. In a split-night PSG, CPAP therapy is started if OSA of sufficient severity is seen during the initial diagnostic segment (often 2-3 hours). The potential for comorbid CSA in stroke patients makes home sleep apnea testing less desirable than gold-standard PSG.¹⁶ OSA is defined as 5 or more obstructive respiratory events per hour of sleep on PSG or 5 or more respiratory events per hour of recording time on home sleep apnea testing, as these limited sensor devices often lack a sleep measure such as electroencephalography.

In stroke patients, OSA has the potential to delay neurological recovery, prolong hospitalization, and increase the risk of recurrent stroke or death, while treatment with CPAP may improve neurological recovery and cognition, reduce subsequent vascular events, and decrease sleepiness and depression.¹⁷⁻¹⁹ The benefits of treating OSA in general, and the possibility of specific gains in this population, warrant the initiation of CPAP. CPAP is the gold-standard of treatment for OSA and uses positive pressure to overcome recurrent airway obstruction.²⁰ The clinician

may initiate CPAP even in the acute post-stroke setting and most investigations demonstrate adequate patient adherence to therapy.¹⁷ CPAP titration, either full night or during the second portion of a split-night polysomnogram, is indicated to determine the optimal pressure setting to resolve obstructive respiratory events.²⁰ The patient should undergo a CPAP titration as soon as possible after stroke to guide therapy; however, given many centers lack the ability to conduct inpatient CPAP titration studies, auto-titrating CPAP is a promising therapy that requires further investigation.^{18,21} Many sleep centers are open-access sleep centers, which allows primary care clinicians to order sleep studies without the patient undergoing a consultation by a sleep medicine physician. However, patients with multiple medical problems may benefit from the care of a board certified sleep medicine physician to guide the evaluation, diagnosis and treatment for sleep problems within an American Academy of Sleep Medicine (AASM) accredited sleep center (clinics and sleep lab).

Stroke patients may possess characteristics that pose a challenge to effective treatment of OSA. Neglect and greater stroke severity reduce CPAP adherence.²² Additionally, cognitive difficulties, apathy, upper extremity weakness, facial droop, and increased oral secretions may lead to difficulty operating the CPAP machine and wearing the CPAP mask interface. Patient and caregiver education and support is critical to ensure successful OSA treatment.

Lifestyle modifications such as weight loss, avoidance of alcohol and other sedatives, and non-supine sleeping positions are recommended in addition to CPAP, but are not typically successful as sole therapy in the general SDB population.²⁰ Alternatives to CPAP such as mandibular advancement devices, surgical interventions, and hypoglossal nerve stimulation, which are effective treatments for OSA, have not been investigated specifically in stroke patients.

In summary, OSA is common in patients who have experienced stroke or TIA and may increase the risk of future stroke or TIA. Given the high prevalence and negative association with desirable outcomes, clinicians should have a low threshold to order diagnostic testing for OSA in this patient population. Treatment of OSA with positive airway pressure (CPAP, BPAP, or other indicated modalities) is both feasible and effective in individuals with stroke and TIA. Positive airway pressure should be initiated at the earliest opportunity to reduce symptoms attributable to sleep-disordered breathing and possibly improve recovery after stroke.

CASE FOLLOW-UP

The patient was referred to a local sleep center. After a thorough clinical sleep consultation, he underwent a split-night polysomnogram. He was found to have an apnea-hypopnea index of 43 events/hour during the diagnostic portion of the study with oxygen desaturations to a nadir of 76%. CPAP set at 14 cm of water was found to effectively treat his OSA and therapy was initiated for home use.

REFERENCES

1. Johnson KG, Johnson DC. Frequency of sleep apnea in stroke and TIA patients: a meta-analysis. *J Clin Sleep Med*. 2010;6(2):131-137.
2. Hermann DM, Bassetti CL. Sleep-related breathing and sleep-wake disturbances in ischemic stroke. *Neurology*. 2009;73(16):1313-1322.
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(5):720-728.
4. Marshall NS, Wong KK, Cullen SR, Knuiaman MW, Grunstein RR. Sleep apnea and 20-year follow-up for all-cause mortality, stroke, and cancer incidence and mortality in the Busselton Health Study cohort. *J Clin Sleep Med*. 2014;10(4):355-362.
5. Lamberts M, Nielsen OW, Lip GY, et al. Cardiovascular risk in patients with sleep apnoea with or without continuous positive airway pressure therapy: follow-up of 4.5 million Danish adults. *J Intern Med*. 2014;276(6):659-666.
6. Campos-Rodriguez F, Martinez-Garcia MA, Reyes-Nunez N, Caballero-Martinez I, Catalan-Serra P, Almeida-Gonzalez CV. Role of sleep apnea and continuous positive airway pressure therapy in the incidence of stroke or coronary heart disease in women. *Am J Respir Crit Care Med*. 2014;189(12):1544-1550.
7. Chang CC, Chuang HC, Lin CL, et al. High incidence of stroke in young women with sleep apnea syndrome. *Sleep Med*. 2014;15(4):410-414.
8. 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):2034-2041.
9. Valham F, Mooe T, Rabben T, Stenlund H, Wiklund U, Franklin KA. Increased risk of stroke in patients with coronary artery disease and sleep apnea: a 10-year follow-up. *Circulation*. 2008;118(9):955-960.
10. Barbe F, Duran-Cantolla J, Sanchez-de-la-Torre M, et al. Effect of continuous positive airway pressure on the incidence of hypertension and cardiovascular events in nonsleepy patients with obstructive sleep apnea: a randomized controlled trial. *JAMA*. 2012;307(20):2161-2168.
11. McEvoy RD, Antic NA, Heeley E, et al. CPAP for prevention of cardiovascular events in obstructive sleep apnea. *N Engl J Med*. 2016;375(10):919-931.
12. American Academy of Sleep Medicine. *International Classification of Sleep Disorders*. 3rd ed. Darien, IL: American Academy of Sleep Medicine; 2014.

13. Joo BE, Seok HY, Yu SW, et al. Prevalence of sleep-disordered breathing in acute ischemic stroke as determined using a portable sleep apnea monitoring device in Korean subjects. *Sleep Breath*. 2011;15(1):77-82.
14. Boulos MI, Wan A, Im J, et al. Identifying obstructive sleep apnea after stroke/TIA: evaluating four simple screening tools. *Sleep Med*. 2016;21:133-139.
15. Iranzo A, Santamaria J, Berenguer J, Sanchez M, Chamorro A. Prevalence and clinical importance of sleep apnea in the first night after cerebral infarction. *Neurology*. 2002;58(6):911-916.
16. 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(3):479-504.
17. Hermann DM, Bassetti CL. Role of sleep-disordered breathing and sleep-wake disturbances for stroke and stroke recovery. *Neurology*. 2016;87(13):1407-1416.
18. Khot SP, Davis AP, Crane DA, et al. Effect of continuous positive airway pressure on stroke rehabilitation: a pilot randomized sham-controlled trial. *J Clin Sleep Med*. 2016;12(7):1019-1026.
19. Aaronson JA, Hofman WF, van Bennekom CA, et al. Effects of continuous positive airway pressure on cognitive and functional outcome of stroke patients with obstructive sleep apnea: a randomized controlled trial. *J Clin Sleep Med*. 2016;12(4):533-541.
20. Epstein LJ, Kristo D, Strollo PJ, Jr., et al. Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. *J Clin Sleep Med*. 2009;5(3):263-276.
21. Bravata DM, Concato J, Fried T, et al. Continuous positive airway pressure: evaluation of a novel therapy for patients with acute ischemic stroke. *Sleep*. 2011;34(9):1271-1277.
22. Minnerup J, Ritter MA, Wersching H, et al. Continuous positive airway pressure ventilation for acute ischemic stroke: a randomized feasibility study. *Stroke*. 2012;43(4):1137-1139.

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