

**HARNEET K. WALIA, MD**

Center for Sleep Disorders, Cleveland Clinic;  
Assistant Professor, Cleveland Clinic Lerner College  
of Medicine of Case Western Reserve University,  
Cleveland, OH; Neurological Institute Center for  
Outcomes Research and Evaluation Scholar, 2016



**BRIEF ANSWERS  
TO SPECIFIC  
CLINICAL  
QUESTIONS**

## **Q:** Should I suspect obstructive sleep apnea if a patient has hard-to-control hypertension?

**A:** Yes. Obstructive sleep apnea is common and is associated with hypertension and resistant hypertension. Physicians taking care of patients who have hard-to-control hypertension should be aware of the possible diagnosis of obstructive sleep apnea and screen them for it. In-laboratory polysomnography or home sleep testing should be offered if appropriate, and if obstructive sleep apnea is detected, it should be treated, as this treatment may help to control blood pressure more effectively.

### ■ OBSTRUCTIVE SLEEP APNEA IS COMMON

Obstructive sleep apnea is characterized by recurrent episodes of partial or complete collapse of the upper airway during sleep, with partial collapse leading to hypopnea and complete collapse leading to apnea. These episodes result in intermittent hypoxemia, microarousals, sleep fragmentation, daytime sleepiness, and impairment in quality of life.

In tandem with the increasing obesity epidemic, the prevalence of moderate to severe obstructive sleep apnea is 17% in men and 9% in women 50 to 70 years old.<sup>1</sup>

### ■ LINKED TO HYPERTENSION

The respiratory events that occur in obstructive sleep apnea are associated with blood pressure surges during sleep that can cause persistent elevated blood pressure while awake. Obstructive sleep apnea has been independently associated with incident hypertension in large epidemiologic studies, even after correction for confounding factors such as obesity and its surrogate markers.

Moreover, the more severe the obstructive

sleep apnea, the greater the risk of incident hypertension.<sup>2</sup> And large, long-term observational studies have shown higher incidence rates of hypertension in people with untreated obstructive sleep apnea than in those who underwent treatment for it with continuous positive airway pressure (CPAP).<sup>3</sup>

Obstructive sleep apnea is also associated with nocturnal nondipping of blood pressure (defined as failure of blood pressure to decline by at least 10% during sleep), which is an independent marker for worse cardiovascular outcomes and hypertension-induced target organ damage.

Obstructive sleep apnea is particularly common in those with drug-resistant hypertension,<sup>4</sup> which is defined as a suboptimal control of blood pressure despite the use of multiple antihypertensive medications of different classes, a condition associated with significant rates of cardiovascular morbidity and mortality. Even in patients at high risk of cardiovascular disease, we found that those with severe obstruction of the upper airway during sleep had fourfold higher odds of having resistant elevated blood pressure.<sup>5</sup>

The seventh Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recognized obstructive sleep apnea as one of the causes of secondary hypertension.<sup>6</sup> The 2013 European Society of Hypertension/European Society of Cardiology guidelines<sup>7</sup> suggested an evaluation of obstructive sleep apnea symptoms for the management of hypertension.

### ■ MECHANISMS LINKING OBSTRUCTIVE SLEEP APNEA AND HYPERTENSION

Pathophysiologic mechanisms that may explain the association between obstructive sleep apnea and hypertension include stimu-

**Obstructive sleep apnea is common; suspect it if hypertension is difficult to treat**

**TABLE 1**

**Signs and symptoms of obstructive sleep apnea**

Daytime sleepiness
Restlessness during the night
Night sweats
Nocturia
Dry mouth
Physical examination findings
Narrow airway
Obesity
Deviated nasal septum
Enlarged tonsils
Macroglossia
Dental overbite
Retrognathia
Narrow maxilla or mandible
High arched palate

lation of sympathetic activity,<sup>8</sup> increased arterial stiffness, and endothelial dysfunction driven by apnea-related intermittent hypoxemia.<sup>9</sup> Increased systemic inflammation and oxidative stress caused by obstructive sleep apnea are other proposed mechanisms.

Conversely, resistant hypertension may worsen obstructive sleep apnea. Some propose that activation of the renin-angiotensin-aldosterone system can cause parapharyngeal edema and rostral fluid shifts during sleep and thereby increase upper airway obstruction and worsen the severity of obstructive sleep apnea.<sup>10</sup>

**■ CONSIDER SCREENING**

Patients with resistant hypertension and risk factors for obstructive sleep apnea should be screened for it, as it is very common in this population.

A simple screening tool that can be used to detect sleep apnea is the STOP-BANG questionnaire<sup>11</sup>:

- **Snore:** Have you been told that you snore loudly?
- **Tired:** Are you often tired during the day?
- **Observed apnea:** Do you know if you stop breathing, or has anyone witnessed you stop breathing while sleeping?

- **Pressure:** Do you have or are you being treated for high blood pressure?
- **Body mass index:** Is your body mass index greater than 35 kg/m<sup>2</sup>?
- **Age:** older than 50?
- **Neck circumference:** greater than 40 cm?
- **Gender:** Male?

A score of 3 or more indicates a high risk of obstructive sleep apnea, and further workup for it is appropriate. Some of the other symptoms and signs are listed in **Table 1**.

**■ SLEEP STUDIES: IN THE LABORATORY OR AT HOME**

In-laboratory polysomnography entails electro-oculography, electromyography, electroencephalography, electrocardiography, pulse oximetry, and measurement of oronasal flow and thoracoabdominal movement (using sensors and belts). It should be performed in patients who have significant comorbid conditions.

A home sleep study, which is more limited than polysomnography, is appropriate in those who have a high probability of obstructive sleep apnea and who do not have other sleep disorders or significant cardiovascular, neurologic, or respiratory disorders.

Subsequently, if obstructive sleep apnea is found, a positive airway pressure titration study is performed to determine the optimal pressure requirements.

**■ CPAP IS THE GOLD STANDARD TREATMENT**

Behavioral changes are recommended to correct factors that predispose to obstructive sleep apnea or aggravate it. These changes include avoiding alcohol, sleeping on one's side rather than supine, weight reduction in overweight individuals, and treating nasal congestion. In some situations, oral appliances or surgical options can be considered. However, CPAP is the gold standard therapy and the one most commonly used.

**■ CPAP LOWERS BLOOD PRESSURE**

Effective treatment of obstructive sleep apnea, added to an antihypertensive regimen, can further lower the blood pressure more than the antihypertensive medication regimen by itself.

**CPAP plus drugs lowers blood pressure more than drugs by themselves**

Several meta-analyses have shown modest improvements in blood pressure with CPAP in hypertensive patients. CPAP's effect on blood pressure seems to be more pronounced in those with resistant hypertension, in whom a meta-analysis of randomized controlled trials demonstrated a mean reduction in systolic blood pressure of 6.74 mm Hg and a mean reduction in diastolic blood pressure of 5.94 mm

Hg.<sup>12</sup> A recent clinic-based (“real-world”) study revealed lowering of blood pressure in patients with resistant and nonresistant hypertension—approximately 2 to 3 mm Hg after CPAP therapy.<sup>13</sup>

Furthermore, a randomized controlled trial in Spain showed that the nocturnal nondipping pattern observed in patients with resistant hypertension was reversed with the use of CPAP.<sup>14</sup> ■

## REFERENCES

1. Peppard PE, Young T, Barnet JH, Palta M, Hagen EW, Hla KM. Increased prevalence of sleep-disordered breathing in adults. *Am J Epidemiol* 2013; 177:1006–1014.
2. Peppard PE, Young T, Palta M, et al. Prospective study of the association between sleep-disordered breathing and hypertension. *N Engl J Med* 2000; 342:1378–1384.
3. Marin JM, Agustí A, Villar I, et al. Association between treated and untreated obstructive sleep apnea and risk of hypertension. *JAMA* 2012; 307:2169–2176.
4. Logan AG, Perlikowski SM, Mente A, et al. High prevalence of unrecognized sleep apnoea in drug-resistant hypertension. *J Hypertens* 2001; 19:2271–2277.
5. Walia HK, Li H, Rueschman M, et al. Association of severe obstructive sleep apnea and elevated blood pressure despite antihypertensive medication use. *J Clin Sleep Med* 2014; 10:835–843.
6. Chobanian AV, Bakris GL, Black HR, et al; Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program Coordinating Committee. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2003; 42:1206–1252.
7. Mancia G, Fagard R, Narkiewicz K, et al; Task Force Members. 2013 ESH/ESC guidelines for the management of arterial hypertension: the task force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *J Hypertens* 2013; 31:1281–1357.
8. Somers VK, Dyken ME, Clary MP, Abboud FM. Sympathetic neural mechanisms in obstructive sleep apnea. *J Clin Invest* 1995; 96:1897–1904.
9. Jelic S, Bartels MN, Mateika JH, Ngai P, DeMeersman RE, Basner RC. Arterial stiffness increases during obstructive sleep apnoea. *Sleep* 2002; 25:850–855.
10. Dudenbostel T, Calhoun DA. Resistant hypertension, obstructive sleep apnoea and aldosterone. *J Hum Hypertens* 2012; 26:281–287.
11. Chung F, Yegneswaran B, Liao P, et al. STOP questionnaire: a tool to screen patients for obstructive sleep apnea. *Anesthesiology* 2008; 108:812–821.
12. Iftikhar IH, Valentine CW, Bittencourt LR, et al. Effects of continuous positive airway pressure on blood pressure in patients with resistant hypertension and obstructive sleep apnea: a meta-analysis. *J Hypertens* 2014; 32:2341–2350.
13. Walia HK, Griffith SD, Foldvary-Schaefer N, et al. Longitudinal effect of CPAP on BP in resistant and nonresistant hypertension in a large clinic-based cohort. *Chest* 2016; 149:747–755.
14. Martínez-García MA, Capote F, Campos-Rodríguez F, et al; Spanish Sleep Network. Effect of CPAP on blood pressure in patients with obstructive sleep apnea and resistant hypertension: the HIPARCO randomized clinical trial. *JAMA* 2013; 310:2407–2415.

ADDRESS: Harneet K. Walia, MD, Center for Sleep Disorders, Neurological Institute, FA20, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH; [waliah@ccf.org](mailto:waliah@ccf.org)



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