

## CASE REPORTS

# Variable Response to CPAP in a Case of Severe Obstructive Sleep Apnea: An Unusual Cause

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The objective of this report is to present clinical and scientific evidence to support the role of head position in the management of obstructive sleep apnea (OSA) with positive airway pressure. OSA, characterized by repetitive obstruction of the upper airway, is a common medical condition associated with daytime somnolence, morning headaches, mood disturbances, and a variety of cardiopulmonary complications. The role of head position during obstructive respiratory events has been largely overlooked. We present a case where OSA severity decreased significantly with the head rotated in the right lateral position compared to head position in the neutral and left position. This case demonstrates an important influence of head position during continuous positive airway pressure titration, independent of trunk position and sleep stage, in patients with OSA, and highlights the utility of the video polysomnography for identifying the variant.

**Keywords:** CPAP, OSA, sleep apnea

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## INTRODUCTION

It is well known that trunk position significantly affects the frequency and severity of respiratory disturbances during sleep, with approximately 50% to 75% of individuals with obstructive sleep apnea (OSA) showing supine predominant or worsening of their OSA.<sup>1</sup> The positional worsening is typically attributed to the effects of gravity, narrowing the anterior-posterior diameter of the upper airway when supine.<sup>2</sup> However, a more elliptoid shape of the upper airway when supine (compared to in the lateral position),<sup>3</sup> as well as positional changes in functional residual capacity,<sup>4</sup> may also be factors influencing positional worsening of OSA.

In addition to trunk position, it has been recently recognized that the position of the head during sleep may play a significant role in OSA severity.<sup>5</sup> This was first described in a study utilizing dual head and trunk position sensors, in which 46.2% of the patients with supine position-dependent OSA were found to have marked differences in their apnea-hypopnea index (AHI) attributed to head position independent of trunk position. Specifically, when in supine sleep, changing the head position from supine to lateral decreased the average AHI from 65 to 17 events/h in men and from 52 to 15 events/h in women.<sup>5</sup>

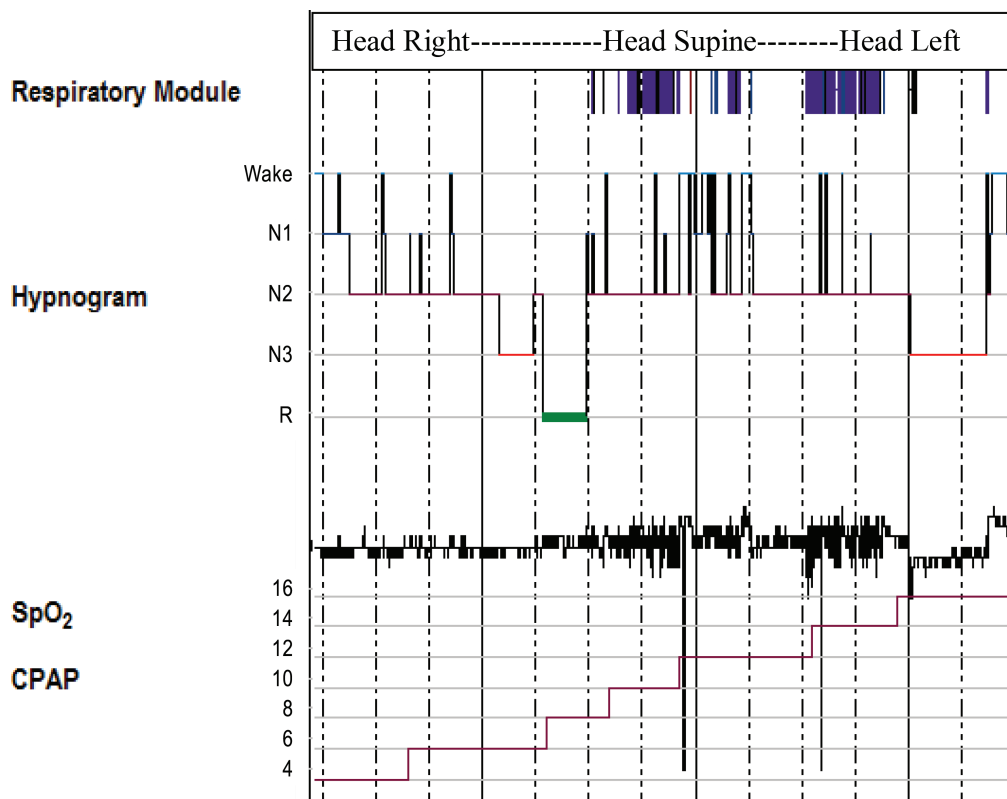
In this case report, we describe a patient with severe OSA who has marked variability in his continuous positive airway pressure (CPAP) responsiveness based on the position of his head, independent of body position.

## REPORT OF CASE

A 46-year-old man presented for evaluation of nonrestorative sleep. He reported snoring, morning headaches, witnessed apneas, episodes of choking/gasping in his sleep, unrefreshing sleep, and daytime sleepiness. His Epworth Sleepiness Scale score was 11 out of 24, and his Pittsburgh Sleep Quality Index score was 15 out of 30, consistent with poor quality sleep.

The patient's vitals were stable, and he had a calculated body mass index of only 17.3 kg/m<sup>2</sup>. The patient was 6 feet, 6 inches tall with a long neck. His nasopharynx was narrowed without septal deviation but with mild erythema, generously large turbinates, and reduced airflow bilaterally. Examination of the oropharynx revealed a Mallampati score of 4, with a low hanging soft palate and a large tongue. The remainder of his physical examination was unremarkable.

The patient underwent a split-night polysomnogram (PSG) on room air with video surveillance. The PSG revealed severe OSA (AHI of 103.9 events/h), with predominant hypopneas and occasional significant oxygen desaturations below 90%. The lowest saturation recorded was 86%. The patient was only observed sleeping in the head and trunk supine position. CPAP was then titrated between settings of 4 cm H<sub>2</sub>O and 16 cm H<sub>2</sub>O, all in the trunk supine position (**Figure 1**). CPAP at 8 cm H<sub>2</sub>O adequately controlled the OSA during supine sleep, but only with the patient's head in the right lateral position, when the residual AHI was 10.5 events/h with no significant oxygen desaturations < 90% (**Figure 2**). This included during 11 minutes

**Figure 1**—Entire time on CPAP as an alternative.

CPAP = continuous positive airway pressure.

of supine stage R sleep. However, when the patient's head was neutral or turned to the left, respiratory events were still seen up to 16 cm H<sub>2</sub>O CPAP (**Figure 3**). There was no significant leak noted on the CPAP at any pressure setting. The patient was evaluated by upper airway imaging, which was unrevealing, and referred for ear, nose, and throat consultation, during which a narrowed cross-sectional area at the base of the tongue, and large nasal turbinates, but no other anatomic abnormalities, were noted. However, the anatomy was not evaluated in different head positions or under drug-induced sleep endoscopy. The patient was subsequently placed on an auto-adjusting CPAP device (adjusted to 4 to 14 cm H<sub>2</sub>O for comfort) with a good clinical response by both symptom control and device-determined AHI on download.

## DISCUSSION

The results from this report provide additional support for the mechanism that head position, independent from trunk position, can be an essential factor in the occurrence of respiratory events during sleep, as well as suggest that this may be a major factor in responsiveness to CPAP therapy.

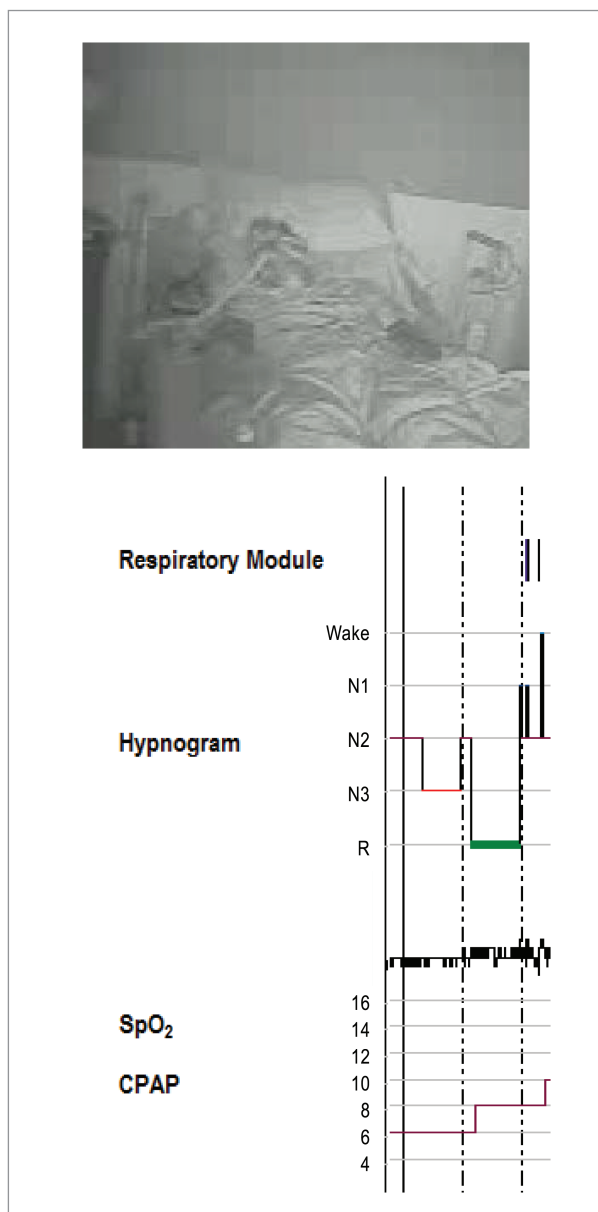
The mechanism for head position-dependent OSA is uncertain but has been speculated to be related to lower effects of gravity on the tongue and soft palate, as well as positional rotational-induced stretching of the upper airway wall, preventing

collapsibility. In a recent study of 67 patients with positional-dependent OSA who underwent drug-induced sleep endoscopy, turning the head laterally during the procedure was associated with decreased complete airway collapse at the velum, tongue base, and epiglottis levels.<sup>6</sup> No difference was noted between right and left head rotation. This procedure was not performed in this patient, but would be of interest.

More work is needed to better understand the mechanisms and clinical implications of head position on OSA, as well as how this may affect CPAP pressure requirements during sleep. The influences of gravity, upper airway shape, and lung functional residual capacity all may be factors important in pressure needs to maintain upper airway patency. Another factor to consider in this patient's case was his significant height and associated long neck, which could influence a tendency toward collapse. These anatomic features raise the possibility of Marfan syndrome, which could predispose the patient to airway collapse and OSA.<sup>7</sup> However, this patient was evaluated for Marfan syndrome by an expert in genetics prior to the diagnosis of OSA, and did not meet diagnostic criteria for this syndrome.

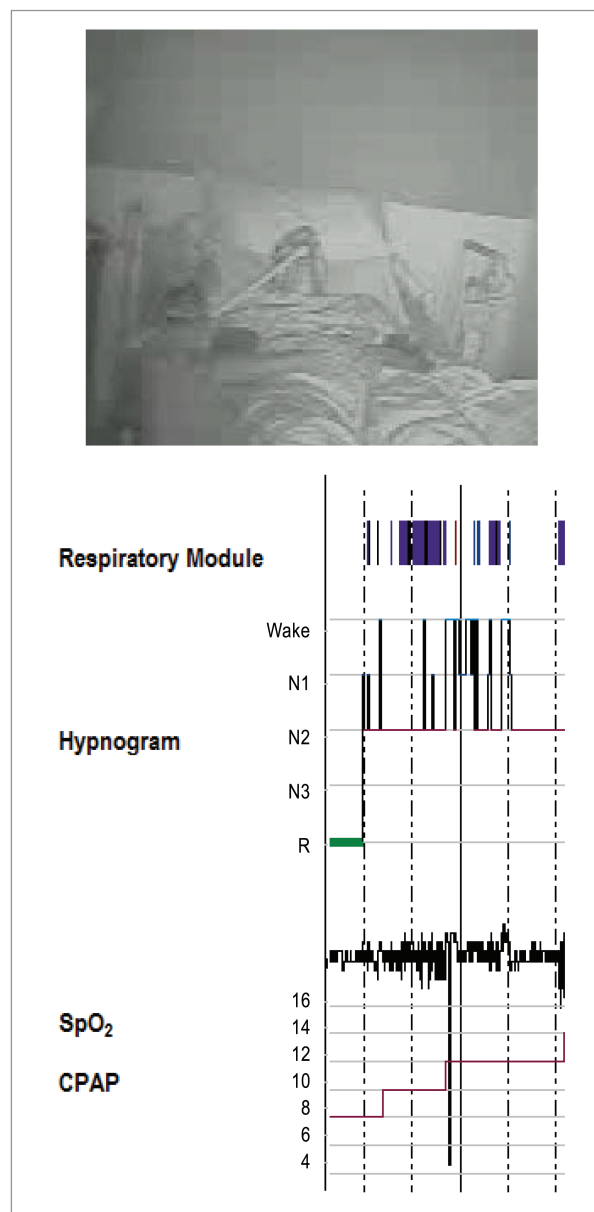
This is the first report documenting how head position may also influence CPAP pressure requirements, and thus offers another explanation for otherwise unexplained variable CPAP pressure requirements during sleep. For this reason, in patients with an index of suspicion of position-dependent OSA, sleep recording with dual position sensors placed on the trunk and

Figure 2—Head turned to the right, body supine.



CPAP = continuous positive airway pressure.

Figure 3—Head supine, body supine.



CPAP = continuous positive airway pressure.

the head should be considered, including during the titration of the positive airway pressure therapies. Reviewing the video can also facilitate making the diagnosis of head position-dependent OSA.

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## SUBMISSION & CORRESPONDENCE INFORMATION

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## DISCLOSURE STATEMENT

Work for this study was performed at MetroHealth Medical Center, Cleveland, OH. The authors report no conflicts of interest.