A Case of Successful Treatment of Sleepwalking Caused by Sleep Apnea Through Continuous Positive Airway Pressure

Gang Wook Seo, Intaek Hwang, Jiyeon Moon, Hyeyun Kim
Sleep Medicine Research Center, Department of Neurology, International St. Mary’s Hospital, Catholic Kwandong University College of Medicine, Incheon, Korea

INTRODUCTION

Sleepwalking or somnambulism is a non-rapid eye movement (NREM) sleep-related parasomnia that is characterized by changes in posture and strange behaviors during night sleep. Somnambulism is often found in adolescents.1 The clinical symptoms range from quietly getting out of bed to running around and behaving inappropriately.

Somnambulism seems to occur when the sleep stage changes during NREM sleep and is the result of incomplete arousal, which decreases the sleep stage from N3 to N1 or N2. Any diseases or situations that trigger arousal may cause sleepwalking symptoms during sleep. Obstructive sleep apnea (OSA) is defined as a disease in which the dilator muscle of the upper airway is relaxed during sleep, which causes airway blockage. The result is the partial or complete closure of the airway, and if proper ventilation is not possible, oxygen desaturation may occur. Consequently, the required respiratory effort to resolve the obstruction increases. If this is not resolved properly, incomplete arousal may occur.2 OSA causes frequent arousals during sleep, and these can be a trigger factor for somnambulism. Here, we present a case of adolescent parasomnia overlap syndrome in which both sleep apnea and sleepwalking were successfully treated using continuous positive airway pressure (CPAP). A review of the literature is also included.

CASE REPORT

A 14-year-old male patient, accompanied by his mother, visited our sleep clinic because he was exhibiting weird behaviors during sleep. Almost every night, the patient would get up, leave his bedroom, and walk around in the house. His mother reported that he would talk to her and drink water each time but the patient did not remember his actions or the content of the conversations afterward. The patient did not complain about any discomfort, although he recently experienced frequent headaches. He had no specific medical or drug histories other than a 2-year history of sleep terror when he was four to six years of age. Examination by an otolaryngologist indicated septal deviation to the left side. The patient's Mallampati score was class I. Based on the otolaryngological examination, surgical treatment was not required. The patient's serology was normal. There were also no abnormal findings on brain mag-
namic resonance images. Furthermore, the patient’s electrocardiogram showed normal sinus rhythm.

Overnight polysomnography (PSG) and electroencephalogram monitoring were performed to exclude nocturnal epilepsy. The PSG showed a total sleep time (TST) of 7 hours and 1 minute, with a sleep efficacy of 81.7%. The patient’s sleep latency was 24.5 minutes, and the REM latency was 61 minutes. The proportion of N1 was 15.5% for the TST. Other results were 48.2% for N2, 21.9% for N3, and 14.4% for REM sleep. The results of the hypnogram are as follows (Fig. 1). Continuous flow limitation with oxygen desaturation was observed with an apnea-hypopnea index (AHI) of 14.1/h. The average oxygen saturation (SpO2) was 95.8%, and the lowest SpO2 was 84.0%. Arousal occurred 97 times (13.9/h) during the patient’s night sleep. Further details showed that the numbers of respiratory-related arousals was 65 (9.3/h) and the respiratory effort-related sleep arousals were 5 (0.7/h). Leg movement-related arousals was 5 (0.7/h), and spontaneous arousals was 22 (3.1/h). Arousal were more concentrated during NREM sleep (87 times [12.4/h]) which was more than in REM sleep (10 times [1.4/h]). The patient’s periodic limb movements during sleep were 10.6/h.

A brief pause in the patient’s breathing pattern was also observed. During this, he appeared to be choking, and then, arousal would occur. Following these events, short bursts of semi-rhythmic theta waves were detected, and at the same time, the patient exhibited sleepwalking and sleep-talking (Fig. 2). A causal relationship between sleep apnea and sleep-
walking was clearly demonstrated. Moreover, apnea during sleep aggravated his sleepwalking. Based on the clinical features and PSG results, the patient was diagnosed as having moderate OSA. CPAP treatment was prescribed. After 12 weeks of CPAP treatment, the record showed a residual AHI of 0.8/h and good CPAP adherence above 90% with more than 4 hours of CPAP use per day. Simultaneously, the patient’s sleepwalking resolved.

**DISCUSSION**

The cause of somnambulism is not clear. Previous twin studies have shown that the DQB1*0501 gene is a risk factor. In addition, some drugs including antibiotics, antipsychotics, antidepressants, lithium, anticonvulsants, selective serotonin reuptake inhibitors, quinine, beta-blockers, and tricyclic antidepressants, have been reported to increase the risk of somnambulism. Sleep deprivation is also a trigger of the disorder. Results from epidemiological studies on somnambulism have found the lifetime prevalence to be 6.9%. Furthermore, the prevalence of somnambulism is significantly higher in children, at 5.0%, than in adults, at 1.5%.

Clear guidelines for the treatment of somnambulism have not been established and clinical treatment does not reflect the relationship between sleepwalking and OSA. Some medications, such as imipramine, diazepam, and clonazepam, are used in cases where severe episodes occur frequently. Such medications are indicated if a patient is awakened or a dangerous situation occurs. However, to date, the efficacy of these medications has not been assessed. Current management strategies for patients with somnambulism mainly focus on creating a safe sleep environment, improving sleep hygiene, and treating any accompanying sleep disorders.

Recent studies have also revealed the close connection between OSA and somnambulism. An epidemiological study of the relationship between OSA and parasomnia found that the prevalence of sleepwalking was significantly higher in patients with OSA. In contrast, other episodes of parasomnia, such as sleep-related violence, sexual acts during sleep, sleep-related eating, and nightmares, were not significantly related to OSA. Importantly, several cases have reported a reduced frequency in sleepwalking events among patients who were treated for OSA. These cases are shown in Supplementary Table 1 (in the online-only Data Supplement).

Oxygen desaturation that results from OSA seems to be the main cause of arousal during sleep. Jaimchariyatam et al. showed that arousal occurs frequently with severe desaturation. It is likely that a reduced oxygen desaturation supply to the brain causes cortical arousal, resulting in an incomplete transition of the stage during NREM. Considering the evidence, sleepwalking and OSA are inextricably linked. Several studies have also confirmed this common pathophysiology for OSA and NREM parasomnia. However, further research is needed to determine if a cause-and-effect relationship exists. Our patient’s sleepwalking improved following CPAP treatment for OSA. Based on this case report, we suggest that CPAP treatment may be useful for controlling sleep symptoms in patients diagnosed with OSA overlap syndrome and NREM parasomnia.

**Supplementary Materials**

The online-only Data Supplement is available with this article at https://doi.org/10.13078/jsm.220021.

**Ethics Statement**

This study was approved by the Institutional Review Board of International St.Mary’s Hospital (Approval no. IS22RISI0027). Informed consent was waived because of the retrospective study and the analysis used anonymous clinical data.

**Conflicts of Interest**

The authors have no potential conflicts of interest to disclose.

**ORCID iDs**

Gang Wook Seo https://orcid.org/0000-0002-5824-5495
Intaek Hwang https://orcid.org/0000-0003-3587-6099
Hyeyun Kim https://orcid.org/0000-0002-8008-5539

**Author Contributions**


**Funding Statement**

This study was carried out with the support of ‘R&D Program for Forest Science Technology (Project No. 2021389B10-2223-0102)’ provided by Korea Forest Service (Korea Forestry Promotion Institute).

**REFERENCES**


**Supplementary Table 1.** Several reported cases of somnambulism associated with OSA in the literature

<table>
<thead>
<tr>
<th>Case number</th>
<th>Demographics</th>
<th>Concomitant sleep disorder</th>
<th>Prior treatment</th>
<th>Successful treatment option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current study</td>
<td>12/M</td>
<td>Moderate OSA (AHI: 14.1/h) sleepwalking/talking/terror</td>
<td>None</td>
<td>Auto-set CPAP (4–15 cmH₂O) residual AHI: 1.7/h after treatment</td>
</tr>
<tr>
<td>Tale et al.¹</td>
<td>42/M</td>
<td>Moderate OSA (AHI: 22.4/h) sleepwalking/incomplete sleep paralysis</td>
<td>CPAP (non-compliant)</td>
<td>Clonazepam 0.25 mg at bedtime</td>
</tr>
<tr>
<td>Sun et al.²</td>
<td>46/M</td>
<td>Severe OSA (AHI: 40.1/h) sleepwalking/terror</td>
<td>Tablet clonazepam 2 mg at bedtime (felt worse; denied taking medication)</td>
<td>Auto-set CPAP (5–18 cmH₂O) residual AHI: 3.2/h after treatment</td>
</tr>
<tr>
<td>Soca et al.³</td>
<td>42/M</td>
<td>Severe OSA (AHI: 41/h) sleepwalking/talking/sex REM sleep behavior disorder</td>
<td>None</td>
<td>CPAP (10 cmH₂O) improved sleepwalking/talking with clonazepam 0.5 mg at bedtime improved sleep and sex</td>
</tr>
<tr>
<td>Lateef et al.⁴</td>
<td>54/F</td>
<td>OSA sleepwalking/driving</td>
<td>None</td>
<td>CPAP</td>
</tr>
</tbody>
</table>

OSA, obstructive sleep apnea; AHI, apnea-hypopnea index; CPAP, continuous positive airway pressure

**REFERENCES**