

Four Cases of Brain Stem Lesion Presented with Central Sleep Apnea Syndrome

Santral Uyku Apne Sendromu ile Prezente Olan Dört Beyin Sapı Lezyonu Olgusu

Nergiz Hüseyinoğlu, Serkan Özben, Hilal Şafak Şanivar

Department of Neurology, Kafkas University School of Medicine, Kars, Turkey

ABSTRACT

Central sleep apnea syndrome is a disorder characterized by the recurrent episodes of apnea during sleep resulting from transient pause of ventilatory effort. Various cardiologic and metabolic causes of the central sleep apnea have been described. In addition, various neurological diseases affecting brainstem have been implicated in the development of the sleep apnea. In this report, we presented four patients with central sleep apnea syndrome and normal neurologic, otorhinolaryngologic and cardiovascular findings. For a further and detailed neurologic examination we performed a magnetic resonance imaging examination and eventually detected pathological findings associated with arachnoid cyst and meningiomas.

Key words: brain stem; central sleep apnea; magnetic resonance imaging; polysomnography

ÖZET

Santral uyku apne sendromu, uyku sırasında solunum çabasının yokluğu nedeniyle oluşan tekrarlayıcı apneler ile karakterize bir hastalıktır. Santral uyku apnesinin çeşitli kardiyolojik ve metabolik nedenleri tanımlanmıştır. Beyin sapını etkileyen farkı nörolojik hastalıklar da santral uyku apnesinin gelişiminden sorumlu tutulmuştur. Burada nörolojik, kulak- burun- boğaz ve kardiyolojik muayeneleri normal olan, santral uyku apne sendromlu dört hastayı sunduk. Daha ileri ve ayrıntılı nörolojik inceleme için beyin manyetik rezonans görüntüleme incelemesi yaptık ve sonunda beyin sapında santral apnelere neden olabilecek araknoid kist ve menenjiomlar saptadık.

Anahtar kelimeler: beyin sapı; santral uyku apnesi; manyetik rezonans görüntüleme; polysomnografi

Introduction

Central sleep apnea (CSA) is a neurological disorder characterized by the recurrent episodes of apnea during sleep resulting from transient pause of ventilatory effort. Central apnea is traditionally defined as the absence airflow with a lack of inspiratory effort lasting at least 10 seconds¹. CSA is seen in less than 10% of patients with sleep apnea and the usual co-existent events are obstructive.

Various causes of CSA have been described. However, in some cases etio-pathogenesis has not been established¹. In order to understand the normal mechanisms regulating the ventilation during sleep and wakefulness, the patho-physiology of the CSA must be lightened. All possible underlying causes of CSA should be investigated during the care of patients with the disorder.

Ventilation during sleep is controlled by complex mechanisms, in where the brain stem and its pathways play an important role. The brain stem is a primary generator for rhythmic breathing pattern during sleep and wakefulness². Therefore, various neurological diseases affecting brain stem have been implicated in the development of sleep apnea. Certain pathological conditions, such as hemorrhage, infarction, tumors, brain stem encephalitis, trauma, Arnold-Chiari malformations, damaging the area may result in breathe dysrhythmias, mostly the central sleep apneas, during sleep^{3,4}.

In this report, we presented four patients with complaints of snoring, hypersomnolence, frequent nocturnal waking and witnessed apneas during sleep. After a full night polysomnographic recording performed between the dates January 2011 and March 2012, we mostly detected central apneas coexisting

with less frequent obstructive apneas. Sleep disordered breathe events were scored manually according to the American Academy of Sleep Medicine criteria⁵.

The patients were investigated for otorhinolaryngologic, cardiovascular and metabolic disorders; however there was not any remarkable finding. Neurological examination was also normal. For a further and detailed neurologic examination we performed a magnetic resonance imaging examination and eventually detected pathological findings associated with arachnoid cyst and meningiomas.

Case 1

After a polysomnographic recording a 46-year-old male patient with a body mass index (BMI) of 22.5 kg/m² was diagnosed with CSA. He had an apnea/hypopnea index (AHI) of 18.7/h and central apnea index of 12.4/h. MRI examination revealed an arachnoid cyst on the brain stem, caudal to the right 7, 8 and 9th cranial nerves (Figure 1). The neurosurgeons offered a clinical observation without surgery. We applied a continuous positive airway

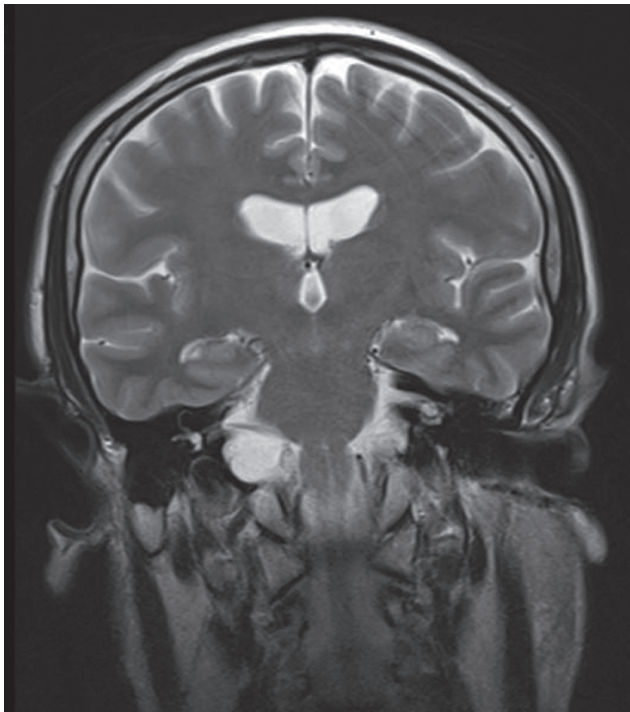


Figure 1. A coronal T2 weighted MRI image of a hyperintense lesion at the right pons and bulbous.

pressure (CPAP) therapy and observed the clinical and polysomnographic improvement of the symptoms.

Case 2

A 75-year-old female patient with a BMI of 27.8 kg/m² was diagnosed with CSA. She had an AHI of 41.6/h and central apnea index of 35.9/h after a polysomnographic recording (Figure 2). Except from a well regulated hypertension, her medical history was unremarkable. A MRI examination revealed a meningioma on the right side of bulbous (Figure 3). The neurosurgeons offered surgery for the intracranial mass, however the patient refused surgery. Now she is under symptomatic medication with acetazolamide 250 mg twice a day. The symptom of daytime sleepiness has improved. CPAP therapy was not started due to the possible risks of complications such as the complex central apnea or intracranial hypertension.

Case 3

A 56-year-old female patient with a BMI of 25.6 kg/m² was diagnosed with CSA. She had an AHI of 16.9/h and central apnea index of 11.5/h after a polysomnographic recording. In the examination of a computerized tomography (CT) (Figure 4) and a contrast enhanced MRI, we detected a mass with the dimensions of 15x10 mm suggesting a meningioma on the left side of the lower bulbous. Surgical intervention was suggested, however the patient refused surgery. She is under periodic follow-up.

Case 4

A 57-year-old female patient with a BMI of 24.3 kg/m² was diagnosed with CSA. She had an AHI of 23.7/h and central apnea index of 13.7/h after a polysomnographic recording. In the MRI examination, a meningioma with 43x33x23 mm dimensions was detected at the right cerebellopontine angle (Figure 5). Surgical removal of the mass was indicated and the patient was referred to another center.

Discussion

Advancements in the electrophysiological, radiological, neuroanatomical and neurochemical techniques have provided sufficient information on the organization of respiratory rhythmogenesis, control of

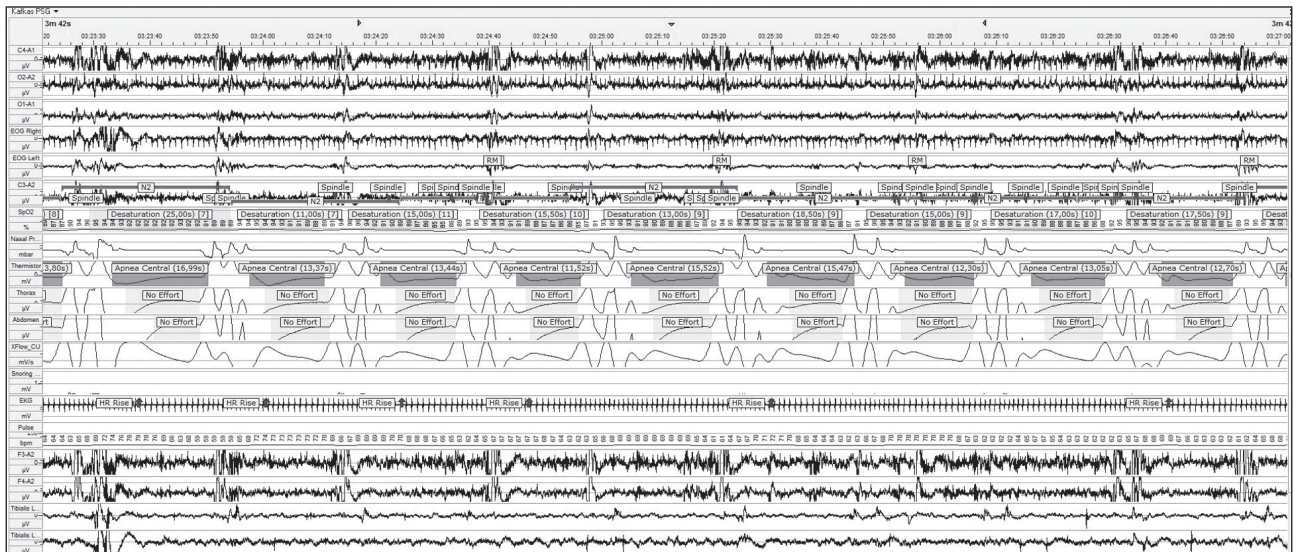


Figure 2. A polysomnographic recording showing central sleep apnea.

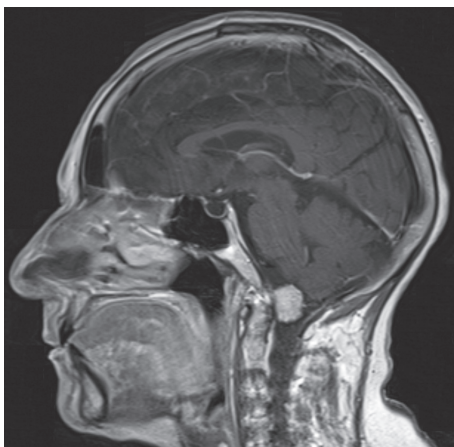


Figure 3. A sagittal contrast enhanced T1 weighted MRI image of a diffuse contrast enhanced lesion at the right lower bulbous.

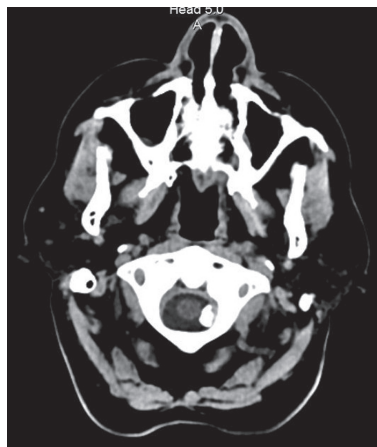


Figure 4. A CT image of a hyperdense lesion at the left lower bulbous.

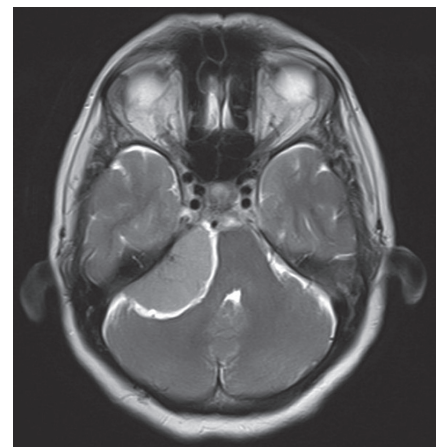


Figure 5. A transverse T2 weighted MRI image of an iso-hyperintense lesion at the right cerebellopontine angle.

respiratory functions and chemosensitivity. There are three processes for the rhythmic breathing.

The first process controlling ventilation is the metabolic control system consisting of the vagally mediated intrapulmonary receptors, complex brain stem mechanisms, and the carotid and medullary chemoreceptors for hypercapnia and hypoxia.

The second system is the behavioral or volitional control systems acting during daily routine practices like eating or talking. The origin of this mechanism is probably located in the forebrain.

The third ventilatory mechanism is the wakefulness stimulus for increasing the ventilation that is inherent to the waking state. The neurons that control this process are located in three regions; nucleus of the solitary tract, the ventrolateral medulla and the dorsolateral pons². Thus, the brain stem and its connections are the important points that control breathing during sleep and wakefulness. Various neurologic disorders affecting brain stem and its pathways have been implicated in the development of the sleep apnea, particularly the central apnea^{3,4}.

In our patients, although we could not find any abnormality in their physical and neurological examination, we detected that the CSAs were more dominant than the obstructive apneas. These findings led us to the suspicion of subclinical brain stem pathology. All patients were investigated for other causes of the CSA, however no cardiovascular, renal or metabolic diseases were detected. All four patients were diagnosed with brain stem pathologies with the help of MRI and CT. The occult pathologies of the patients were slowly growing masses of arachnoid cyst and meningioma. Probably the characteristic of the slow growth and progression of the lesions resulted in sleep apnea related symptoms instead of localized neurologic deficits. From this point of view, a brain imaging examination should be offered in the patients with a predominant CSA, even if their clinical and physical examinations are normal.

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