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ORIGINAL ARTICLE

Role of continuous positive airway pressure in patients with combined sleep apnea syndrome without congestive heart failure

Shereen Farghaly [1,*], **Alaa Thabet** [2]

Chest Department, Assiut University Hospital, Egypt

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KEYWORDS

Heart failure;
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CPAP;
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Abstract Continuous positive airway pressure (CPAP) is a standard treatment of moderate and severe obstructive sleep apnea syndrome. However, its effect in patients with coexisting obstructive and central apneas is controversial.

Objectives: To determine the immediate response to CPAP in combined obstructive and central sleep apnea patients without heart failure.

Methods: Thirty seven consecutive patients with moderate and severe coexisting obstructive and central apneas (combined group) were prospectively enrolled in this cross sectional analytic study. All patients underwent a full night-attended and a full night CPAP titration polysomnography. Titration was considered successful if AHI < 10 and the titration study included at least 15 min in REM stage.

Results: On CPAP titration, the combined group showed significant improvement in sleep and respiratory polysomnographic parameters. Mean AHI was reduced from 71.9 ± 30.3 to 8.39 ± 5.15 ($P = 0.000$). Whereas CPAP significantly reduced the central apnea index from 12.8 ± 6.67 to 3.1 ± 2.86 ($P = 0.000$), the response to central events was variable (ranged from 20% to 100%). Overall results, 25 (67.6%) had successful titration with significant better response in females than males to CPAP than males (88.9% vs. 60.7%, $P = 0.019$).

Conclusion: CPAP can be effective in combined obstructive and central apnea patients without heart failure with consideration of individual variability. A trial of CPAP titration should be done in those patients.

* Corresponding author at: Chest Department, Assiut University Hospital, Zip Code: 71111, Egypt. Tel.: +20 01003085436.
E-mail addresses: shereen_hssn@yahoo.com (S. Farghaly), alaathabet35@yahoo.com (A. Thabet).

[1] Has a role in design of study, analysis of results and discussion of results.
[2] Has a role in design of study, revision of the results and decision of final publishing.

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Introduction

Sleep related breathing disorders (SRBD) have been recently classified into obstructive sleep apnea syndrome (OSAS), the central sleep apnea syndrome (CSAS) and Cheyne–Stokes respiration (CSR) [1]. Due to overlap of mechanisms of upper airway obstruction and ventilatory instability causing these disturbances, one patient could present with combination of obstructive and central events in one night. This condition is commonly present in patients with congestive heart failure but can interestingly occur without heart failure [2].

Continuous positive airway pressure (CPAP) acts as a pneumatic splint to the upper airway during sleep and corrects the obstruction. It therefore can improve oxygenation and sleep architecture [3]. While the treatment of obstructive sleep apnea syndrome is generally straight forward and successful with CPAP therapy, [4] treatment of sleep apnea with predominantly mixed apneas, CSA and CSR is not universally agreed upon. CSA occurring with episodes of obstructive or mixed apnea may respond to nasal CPAP therapy [5–7]. One possible explanation is that CPAP increases lung volume and oxygen stores and alleviates hypoxia. Also, it prevents the occurrence of upper airway narrowing or occlusion during central apnea resulting in decreasing ventilatory overshoot and stabilization of ventilation [8]. Other reports have demonstrated either no change or a worsening of apnea/hypopnea index (AHI) during acute administration of nasal CPAP [9,10]. Depending on these results, a trial of CPAP may be effective in treatment of patients with coexisting obstructive and central sleep apnea.

Aim of the study

To determine the immediate effect of CPAP on elimination of apneas, improvement of oxygenation and sleep architecture in combined obstructive and central sleep apnea patients without heart failure.

Patients and methods

Patient selection

Inclusion criteria

We included adult patients with coexisting obstructive and central sleep disordered breathing (combined group) (diagnosed by polysomnography as total AHI $\geqslant$ 15 and central AHI $\geqslant$ 5 and the central AHI $<$ 50% of total AHI).

To be eligible for enrollment in the study, patients should undergo full night diagnostic and full night CPAP titration polysomnographic study.

Exclusion criteria

- Patients with pure OSAS.
- Patients associated with other pulmonary diseases as COPD, asthma, interstitial lung disease, bronchiectasis etc.
- Patients with left-sided heart failure.
- Patients who developed claustrophobia or excessive mask leak (leak $>$ 0.04 L/s $>$ 20% of total sleep time) during CPAP titration.
- Patients with split night sleep study.

Study design

This cross-sectional analytic study was carried at the sleep laboratory of the Chest Department of Assiut University Hospital. An informed written consent was obtained from all the patients enrolled in the study. The study was approved by the Faculty of Medicine Ethics Committee, Assiut University. Over a period of one and half years, we assessed patients coming for full night polysomnography. Patients with moderate to severe combined sleep apnea were prospectively enrolled in the study and prepared for second full night attended CPAP titration sleep study.

Clinical assessment

Clinical history suggestive of sleep apnea syndrome was taken from the patients and their partner with a history of associated co-morbid disease as diabetes mellitus, hypertension or IHD. Physical assessment including anthropometric measurement of height, weight and body-mass index (BMI) and reviewing of patients pulmonary function tests, previous chest X-ray and echocardiography was carried out.

Polysomnography

All patients underwent full over-night attended diagnostic as well as therapeutic (on CPAP) polysomnography (Sleep Lab Pro, Jaeger, VIASYS Healthcare Hoechberg, Germany). On both the two nights, the polysomnogram systematically monitored electroencephalogram (EEG) (C3-A2, C4-A1), electro-oculogram (EOG), electromyogram of the chin (EMG), electrocardiogram (EKG), nasal and oral airflow (using oronasal flow thermistor in the diagnostic study and a piezoelectric pressure sensor to record mask pressure in the therapeutic study), thoracic and abdominal effort (using piezoelectric belts), limb movements (by means of EMG on anterior tibialis muscle), pulse oximetry, body position (recorded by a position sensor) and snoring sound level (by means of a microphone placed externally to the trachea).

CPAP titration

CPAP therapy was introduced with full night attended polysomnography within 3 weeks after the diagnostic study. All patients received CPAP via an oronasal mask which was selected individually. The auto mode of CPAP device (Resmed, Autoset spirit™) with a pressure range of 4–20 cm H_2O was used for automatic titration. It automatically increased or decreased mask pressure in response to snoring or the presence of apneas or hypopneas, thus acting to completely restore airway patency. It detected degree of obstruction by reviewing the shape of the inspiratory flow curve on a breath-by-breath basis. A normal unobstructed breath gives a smooth rounded curve shape, but, as the upper airway narrows, flattening of the curve occurs, altering the shape. The degree of flattening determines the response of the device [11]. Preparation of the patients was done by a technician who supervised the study, and adjusted the mask fit to compensate for leak and patient discomfort.