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# Prevalence of masked and nocturnal hypertension in patients with obstructive sleep apnea syndrome



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## ABSTRACT

**Introduction:** Obstructive sleep apnea (OSA) is considered as a risk factor for the development and worsening of compensation of arterial hypertension and other cardiovascular diseases. Prevalence of masked and nocturnal hypertension can have a significant negative impact on these patients and these prevalences are not well known.

**Aim:** To evaluate the prevalence of masked and nocturnal hypertension in patients with OSA.

**Materials and methods:** In this study, 97 (88 men) patients were enrolled, average age  $53.9 \pm 9.7$  years. OSA was diagnosed with polysomnography and the continuous positive airway pressure therapy has been indicated according to current guidelines. Then were evaluated parameters of OSA (apnea-hypopnea index (AHI), oxygen desaturation index (ODI), % of sleep time  $<90\%$  SpO<sub>2</sub>, average night SpO<sub>2</sub>). Patients also underwent physical examination including office blood pressure measurement, 24 h blood pressure monitoring (ABPM) and measurement of anthropometric parameters.

**Results:** Following average values were present in OSA patients (mean value and standard deviation): AHI  $54.6 \pm 22.7$ , ODI  $58.3 \pm 24$ , % of sleep time  $<90\%$  SpO<sub>2</sub>  $35.4 \pm 25.1$ , average night SpO<sub>2</sub>  $88.8 \pm 5$ . Masked hypertension was present in 55 (56.7%) patients, nocturnal hypertension in 79 (81.4%) patients. Arterial hypertension was appropriately compensated in only 15 (15.5%) patients. Results have not shown any statistically significant correlation between prevalence of nocturnal hypertension and AHI ( $p = 0.059$ ), % of sleep time  $<90\%$  SpO<sub>2</sub> ( $p = 0.516$ ), average night SpO<sub>2</sub> ( $p = 0.167$ ). ODI was significantly higher in patients with nocturnal hypertension ( $p = 0.002$ ). No correlation between prevalence of masked hypertension and AHI ( $p = 0.841$ ), ODI ( $p = 0.137$ ), average night SpO<sub>2</sub> ( $p = 0.991$ ) and % of sleep time  $<90\%$  SpO<sub>2</sub> ( $p = 0.896$ ) has been present.

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**Abbreviations:** ABPM, 24 hour ambulatory blood pressure monitoring; AHI, apnea-hypopnea index; BMI, body mass index; D I, II, masked hypertension definition III; MH, masked hypertension; NH, nocturnal hypertension; ODI, oxygen desaturation index; OSA, obstructive sleep apnea; mBP, mean blood pressure; SpO<sub>2</sub>, blood oxygen saturation; BP, blood pressure.

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**Conclusion:** This study has demonstrated high prevalence of masked and nocturnal hypertension in patients with OSA, which can considerably increase risks of cardiovascular diseases in these patients.

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## Introduction

Obstructive sleep apnea (OSA) is a common chronic disorder and its clinical presentation has been well known for many centuries. In 330 AD Claudius Aelianus described typical signs of OSA in the king of Portus, whose servants had to awake him with needles to avoid choking. Prevalence of this disorder is described in 2–4% of middle aged individuals [1]. Common signs are snoring with apneic and hypopneic pauses and frequent micro arousals [2]. Consequences are disturbance of sleep architecture and repeated awakening, which can be accompanied by insomnia, nocturnal polyuria and dry mouth. Patients suffer from poor quality of sleep and pronounced tiredness. Increased sleepiness occurs during daytime and mainly while performing monotone activities. Concentration and memory are worsening, depression and sexual dysfunctions could also occur [3].

Nowadays, this syndrome is considered as a risk factor for development of cardiovascular and metabolic disorders such as ischemic heart disease, arterial hypertension, diabetes mellitus, heart conductance abnormalities and cerebrovascular disorders [4–6]. Nevertheless, only a limited number of physicians are evaluating sleep disorders – in our pilot study only 13% of all physicians treating patients with heart arrhythmias were directly asking patients about this syndrome. Same situation can be expected in other groups of high risk patients [6].

Relationship between OSA and arterial hypertension is under intensive evaluation because arterial hypertension doubles the risk of cardiovascular diseases (including myocardial infarction), congestive heart failure, ischemic and hemorrhagic stroke, renal failure and diseases of peripheral arteries [7].

Arterial hypertension is present in approximately 50% of patients with OSA. In comparison, the common prevalence of arterial hypertension in population of same patients without OSA is 30% [8]. OSA is increasing the risk of arterial hypertension independently on other factors – Sleep Heart Health Study showed linear correlation between systolic and diastolic blood pressure level and severity of OSA [9]. In these patients, arterial hypertension is present mostly during night and it has a form of so called non-dipper type (blood pressure level during nighttime is the same or higher than during the day) [5,10]. In patients with resistant arterial hypertension, OSA is present in up to 83% of patients [11]. From these findings emerges the fact that in all patients with resistant arterial hypertension (patients taking combination of at least three antihypertensive drugs, one of which is a diuretic) OSA should be excluded.

Masked hypertension (MH) is defined as a blood pressure which is higher during home measurement-24 h blood pressure monitoring (ABPM) or self monitoring) than casual blood pressure level measured in an office [12]. Prevalence of masked hypertension in general population is estimated to be 10–25% [13–15]. An arbitrary threshold of masked hypertension was defined as blood pressure >135/85 mmHg measured by ABPM during daytime [13]. Mere assessment of blood level pressure during the day does not detect nocturnal hypertension which then remains unrecognized. The prevalence of cardiovascular complications in patients with MH is twice as high as in common population and MH is significantly under diagnosed [16]. In previous years, only few studies have evaluated the prevalence of MH in patients with OSA [17,18]. Common finding of these studies is the fact that prevalence of MH is higher in OSA patients in comparison with general population.

The aim of this study was to assess the prevalence of masked and nocturnal hypertension in patients with OSA indicated for continuous positive airway pressure therapy according to current guidelines and to evaluate their dependency on parameters of OSA.

## Materials and methods

97 patients (88 male) were enrolled in this study, average age  $53.9 \pm 9.7$  years. We included consecutively examined patients from Sleep laboratory of Department of Respiratory Medicine, Palacky University and University Hospital Olomouc with diagnosis of OSA (using polysomnography (Alice 5, Respiromics, USA)) who were indicated for continuous positive airway pressure therapy (CPAP) (apnea-hypopnea index >15). Out of included patients, 84 had a history of previously treated arterial hypertension and they were treated with substances from all of main pharmacotherapeutical classes of antihypertensive drugs. Then we evaluated parameters of OSA: apnea-hypopnea index (AHI), oxygen desaturation index (ODI), average night SpO<sub>2</sub> a % of sleep time <90% SpO<sub>2</sub>. Then we performed physical examination including blood pressure (BP) measurement (standard sphygmomanometer, average of second and third measurement as a result), according to guidelines arterial hypertension threshold was defined as 140/90 mmHg. Later we measured following parameters: body mass index (BMI-patient's weight (kg)/height (m)<sup>2</sup>), waist and hip circumference and Epworth sleepiness scale.

Following exclusion criteria were applied in this study: ejection fraction <50%, significant heart valve disorder, diagnosed cause of secondary arterial hypertension other than OSA, pulmonary fibrosis, chronic obstructive pulmonary

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