

A Case Report of Acute Pulmonary Embolism and Obstructive Sleep Apnea

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Abstract

Introduction: Obstructive sleep apnea (OSA) is characterized by frequent episodes of upper airway collapse during sleep, associated with intermittent arterial oxygen desaturation.

OSA is also being recognized as an independent risk factor for several clinical comorbidities, including systemic hypertension, cardiovascular disease, stroke, and abnormal glucose metabolism.

Intermittent hypoxia is responsible of oxidative stress and inflammatory response that in turn can modify endothelial function and increase intravascular coagulation, possible pathogenetic mechanisms of pulmonary embolism (PE).

Case Report: 56-year-old woman (no smoking, with normal weight), has a diagnosis of PE. The search for triggering factors was negative. At the three-month follow-up, she had been subjected to home sleep apnea test (HSAT), that demonstrated a moderate OSA. She was then adapted to nasal continuous positive airway pressure (CPAP), with benefit.

Conclusion: Several previous case reports and uncontrolled cohort studies suggested a possible association between OSA and PE.

We describes a case of patient with PE and OSA; in all patients suspected of having an acute PE and without other risk factors, it would be useful to perform a night-time cardio-respiratory monitoring to analyze the possible presence of obstructive sleep apnea.

Keywords: *Obstructive Sleep Apnea; Pulmonary Embolism; Intermittent Hypoxia; Reactive Oxygen Species*

Abbreviations

A: Apnea; CA: Central Apnea; OA: Obstructive Apnea; ODI: Oxygen Desaturation Index; OSA: Obstructive Sleep Apnea; PE: Pulmonary Embolism; CPAP: Continuous Positive Airway Pressure; H: Hypopnea; HSAT: Home Sleep Apnea Test; ROS: Reactive Oxygen Species; CTA: Computed Tomographic Angiography; SpO₂: Mean of Saturation; T < 90%: Percent of the Total Time with Oxygen Saturation Level Lower the 90%

Introduction

Obstructive sleep apnea (OSA) is a respiratory disorder of sleep, characterized by frequent episodes of upper airway collapse during sleep, affecting nocturnal sleep quality and ensuing daytime fatigue and sleepiness [1].

The recurrent episodes of complete or partial airway obstruction are associated with intermittent arterial oxygen desaturation [2,3].

Increasingly, obstructive sleep apnea is also being recognized as an independent risk factor for several clinical consequences, including systemic hypertension, cardiovascular disease, stroke, and abnormal glucose metabolism [4-7].

Patients with OSA may suffer from repeated episodes of hypoxia and normoxia, which are in many ways reminiscent of ischemia-reperfusion events, and are currently believed to promote the production of reactive oxygen species (ROS) and the promotion of oxidative stress, as well as in ischemia-reperfusion injury to the vascular wall, resulting in increased risk for atherosclerosis [8].

A relationship between sleep disordered breathing and pulmonary embolism was first suggested more than 30 years ago in case reports of pulmonary embolism (PE) in patients with the so-called Pickwickian syndrome [9,10]. Several more recent studies have examined the prevalence of OSA in uncontrolled case series of patients with acute PE [11,12].

A small, uncontrolled, prospective cohort study of patients with newly diagnosed OSA found an increased incidence of venous thromboembolism over 3 years following OSA diagnosis [13].

Several studies emphasized the importance of early identification of risk factors of PE: one of these factors is OSA for which, in addition to oral anticoagulant therapy, the nasal continuous positive airway pressure (CPAP) treatment can reduce treating this condition, platelet activation and increase fibrinolytic capacity [14,15].

Case Presentation

A 56-year-old female (no smoking, with normal body mass index 23 Kg/m²), was admitted to our hospital because of dyspnea that had become progressive, atypical chest pain and fever.

On admission, body temperature was 38°C; blood pressure was 130/90 mm Hg, heart rate was 96/min, rhythmic; breathing rate was 20/min. A mild systolic murmur was heard on the right parasternal margin. Respiratory sounds were substantially normal.

The arterial blood gas analysis showed a pattern of hypoxic-hypocapnic respiratory failure (pH: 7,50, PaO₂: 58 mmHg; PaCO₂: 30 mmHg).

Results of laboratory investigations are shown in table 1.

Variables	Results
White blood cell	11.800/ul
Hemoglobin	11.4 g/dl
Platelet count	226.000 u/l
D dimer	6.58 ng/ml (n.v < 0.5)
C-reactive protein	23.47 mg/dL
Procalcitonin	0.26 mg/dL
Glucose	98 mg/dL
Creatinine	0.90 mg/dL

Table 1: Results of the initial laboratory tests.

Chest X-ray showed normal lung parenchyma. Computed tomographic angiography (CTA) was consistent with PE (Figure 1). In the medical history of patient were absent the risk factors such as taking hormone replacement therapy, having high blood pressure, having had recent injury or trauma to a vein, having burns or fractures of the hips or thigh bone and having been inactive or immobile for long periods time.

In table 1 is showed the main laboratory tests performed.

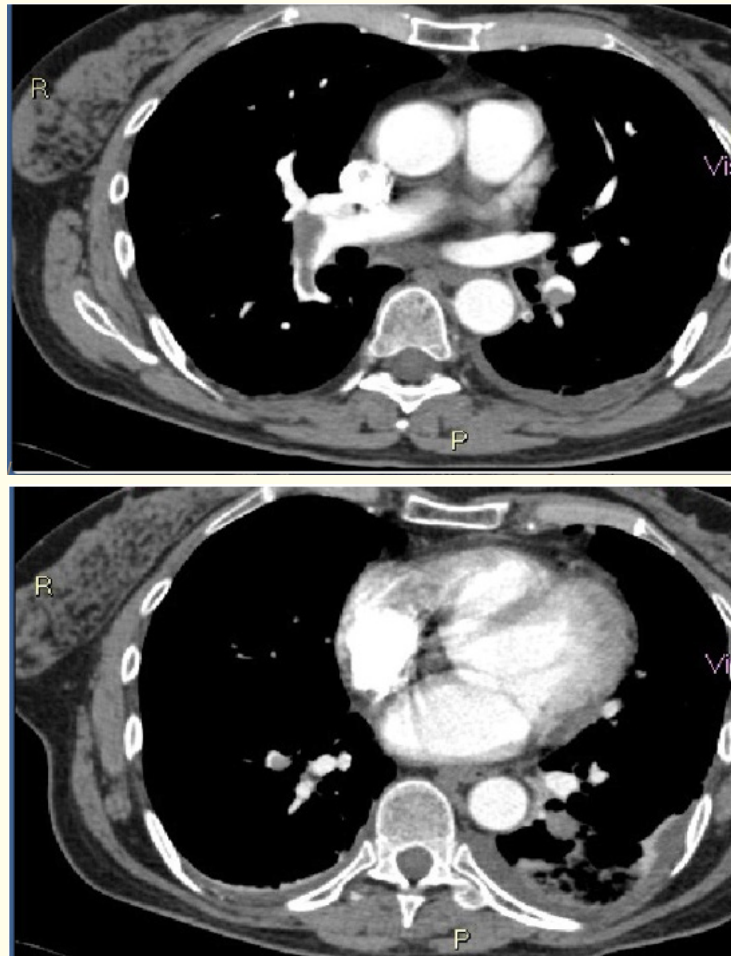


Figure 1: Images of computed tomographic angiography.

The determinations of antiphospholipid-dependent antibodies, beta2 glycoprotein, antibodies anticardiolipin and lupus anticoagulant were normal. Hereditary thrombotic risk factors were also determined: homocysteinemia, mutations of factor V, mutation factor II, antithrombin, protein C, protein S were all normal.

Doppler ultrasound exam of legs, echocardiogram, neoplastic markers were found to be negative.

After stabilizing clinical setting and introducing therapy with dabigatran, the patient was discarded.

Case follow up

At 3 months follow-up, due to reported excessive daytime sleepiness and weakness, snoring, disturbed night sleep, morning headaches, the patient underwent a home sleep apnea test (HSAT) in room air, overnight. Apneas (As), hypopneas (Hs) and apnea-hypopnea index (AHI), obstructive apnea (OA), central apnea (CA), oxygen desaturation index (ODI), mean of saturation (SpO_2), the percent of the total time with oxygen saturation level lower the 90% ($t < 90\%$) were defined according to current criteria [16]. The exam revealed an AHI of 18.5 events/h with several prolonged episodes of obstructive sleep apnea with a mean duration of 31% (Table 2 and Figure 2).

n° Obstructive Apnea - index/h	32 - 4,7
n° Hypopnea - index/h	90 - 13
n° Central Apnea - index/h	2- 0.30
n° Apnea/Hypopnea - index/h	122 -18,3
n° Oxygen Desaturation/h - index/h	120 - 18
SpO ₂ mean %	92%
t < 90 %	28%

Table 2: Values of basal HSAT.

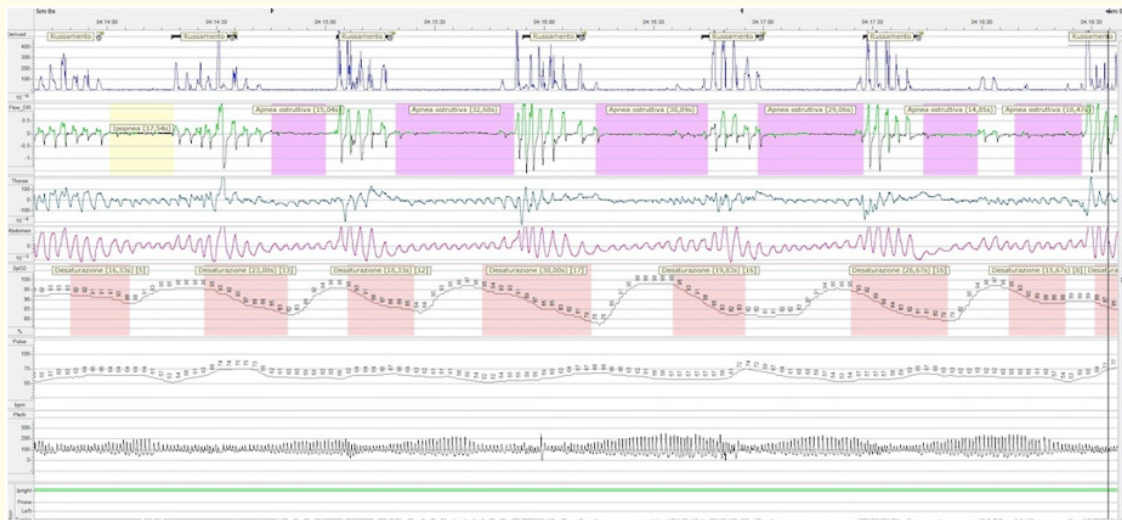


Figure 2: Images of basal HSAT.

The patient, at a new examination, showed a Mallampati of 4 and a micrognathia with second class malocclusion.

It has been subjected to dental and otolaryngological screening and adapted to CPAP therapy with benefit and good correction of polygraphic indexes.

Discussion

OSA is emerged as an important public health problem.

It is repetitive partial or complete obstruction of the upper airway during sleep. These events break down into obstructive apneas-complete obstruction of the upper airway for ≥ 10 seconds or hypopneas-incomplete upper airway obstruction resulting in either decline in oxygen levels (3 or 4% desaturation) or arousal from sleep. The syndrome of OSA (obstructive sleep apnea syndrome) is usually defined by an apnea-hypopnea index (AHI) (apneas + hypopneas/ hours of total sleep time) of ≥ 5 and symptoms of excessive daytime sleepiness, unrefreshing sleep, or chronic fatigue [16].

Estimates of OSA prevalence are in the range of 3% to 7%, with certain subgroups of the population bearing higher risk [1].

Factors that increase vulnerability for the disorder include age, male sex, obesity, family history, menopause, craniofacial abnormalities, and certain health behaviors such as cigarette smoking and alcohol use [1].

Several comorbidities have been associated with OSA.

OSA is currently known to play a role in the pathogenesis of several cardiovascular diseases, including systemic hypertension, congestive heart failure, pulmonary hypertension, arrhythmias, cerebrovascular events, and acute coronary syndromes [6,8,17-21]. There is some evidence for a hypercoagulable state; the causes include hemodynamic alterations, sympathetic nervous system activation, oxidative stress, systemic inflammation, hypercoagulability and vascular endothelial dysfunction. These pathophysiologic derangements are prothrombotic and could promote the development of venous thromboembolic disease [15,22].

A relationship between sleep disordered breathing and PE was first suggested more than 30 years ago in case reports of PE in patients with the so-called Pickwickian syndrome [9,10].

Several previous case reports and uncontrolled cohort studies have suggested a possible association between OSA and pulmonary embolism (PE) [11,12].

OSA-related hemodynamic alterations may lead to acute reductions in venous return and chronic venous stasis. OSA is associated with increase in circulating thrombogenic factors, such as fibrinogen, von Willebrand Factor, platelet activation, plasminogen activator inhibitor-1, and D-dimer levels. Also, OSA directly impairs vascular endothelial function: both an increase in endothelin-1 levels, which may lead to vasoconstriction, and a reduction in nitric oxide, which may impair vasodilatation, have been showed [6,14,18,19]. Furthermore, OSA is associated with sympathetic nervous system activation and increase in inflammatory mediators, catecholamines, cellular and vascular endothelial adhesion molecules, and oxidative stress with higher productions of ROS levels, that in turn can up-regulate vascular adhesion molecules, cause platelet aggregation, and scavenge the potent vasodilator nitrogen oxide [8,22].

In our case it was showed the presence of pulmonary embolism and obstructive sleep apnea in absence of other risk factors.

Therefore, OSA itself may represent a risk factor for the development of PE.

At the presentation of pulmonary embolism can be useful also to perform overnight HSAT to evaluate the presence of OSA condition.

Conclusions

In summary, we explain a case with OSA and PE. In according with some previous studies, we support the concept that OSA may represent an independent risk factor for the development of PE. Given the high prevalence of OSA and the high morbidity and mortality associated with comorbidities, additional studies are needed to confirm this relationship.

Availability of Data and Materials

Not applicable.

Authors' Contributions

Ok conceptualized the Case study, participated in the literature review, was involved in drafting the manuscript, gave final approval of the version to be published. KG conceptualized the case study, had overall responsibility for the manuscript conduction, the critical revision of the case report for important intellectual content and final approval of the version to be published. All authors read and approved the final manuscript.

Consent to Publish

Written informed consent was obtained from the patient for publication of this Case report. A copy of the written consent is available for review by the Series Editor of this journal.

Acknowledgments

None.

Competing Interests

All authors declare that they have no competing interests.

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