Original Article

Findings of a Berlin Questionnaire survey: Comparison between patients seen in an asthma clinic versus internal medicine clinic ☆,☆☆

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Abstract

Background: Obstructive sleep apnea (OSA) and asthma are common and share similar nocturnal symptoms. We hypothesized that the prevalence of OSA symptoms would be greater in asthmatics compared to a general internal medicine population.
Methods: Patients in the Asthma Clinics ($n = 177$) and Internal Medicine Clinics ($n = 328$) at MetroHealth Medical Center, an urban academic institution, were surveyed for OSA risk. Patients completed the Berlin Questionnaire, a validated questionnaire with a positive predictive value (ppv) of 0.89 for determining the presence of OSA in primary care populations. All asthmatics had spirometry performed.
Results: The asthma group had more females ($p = 0.01$) and a higher mean body mass index (33.2 vs. 31.2 kg/m^2, $p = 0.02$). However, the percentage with a body mass index >30 kg/m^2 was not different between the groups ($p = 0.19$). The internal medicine group had a much higher rate of hypertension ($p = 0.002$) and diabetes ($p < 0.001$). Asthmatics were more likely to report frequent snoring (18.5% vs. 8.0%, $p < 0.001$) and chronic sleepiness (46.1% vs. 34.3%, $p = 0.01$). OSA risk, as determined by the Berlin Questionnaire, was higher in the asthma group than in the internal medicine group (39.5% vs. 27.2%, $p = 0.004$). In the asthma group, risk for OSA did not correlate with asthma severity ($p = 0.183$).
Conclusions: This study suggests a possible association between asthma and OSA. There is a higher prevalence of OSA symptoms in an asthmatic population when compared to a primary care population, independent of the severity of the asthma.
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Keywords: Asthma; Sleep apnea; Sleep apnea symptoms; Pulmonary epidemiology; Berlin Questionnaire

1. Introduction

Obstructive sleep apnea (OSA) is increasingly common, with recent estimates suggesting a prevalence of 5% [1]. Asthma prevalence has also risen, and it is estimated that 7.5% of adults in the United States are asthmatics [2]. Asthmatics are known to have disturbed and poor sleep, often attributed to nocturnal worsening of their asthma [3,4]. A survey study found that 39% of patients with various degrees of asthma had disturbed sleep on a nightly basis [5]. Asthmatics also often report increased daytime sleepiness [3,6]. In a large community-

based survey of respiratory symptoms, asthmatics reported a higher prevalence of snoring as compared to the general population [7]. As snoring and daytime sleepiness are common symptoms in OSA, these data suggest a possible association between these two conditions. Recently, it has been suggested that the sleepiness reported by asthmatics is associated with sleep apnea risk and not asthma severity [8]. Of interest, a study of 788 children who underwent in-home unattended sleep studies found an association between sleep-disordered breathing and a history of wheezing, but not a parent-reported diagnosis of asthma [9].

It has yet to be conclusively determined whether asthma and OSA are simply two common conditions with similar symptoms or whether there is a pathophysiologic or causal association between the two. Recent data suggests that OSA is linked to increased bronchial hyperresponsiveness [10] and is an independent risk factor for asthma exacerbations [11]. Furthermore, continuous positive airway pressure (CPAP) treatment of OSA in asthmatics decreases nocturnal asthma symptoms [12,13] and may improve daytime peak flows [14]. Given these findings and the recognition that OSA is underdiagnosed [15], it is clinically relevant to determine the prevalence of OSA in the asthma population. We hypothesized that, utilizing a validated OSA screening tool, the prevalence of OSA symptoms and thus risk for OSA would be greater in asthmatics when compared to a general internal medicine population.

2. Materials and methods

2.1. General study design

A prospective questionnaire survey study was performed in the Asthma Clinics and Internal Medicine Clinics at MetroHealth Medical Center (MHMC) in Cleveland, Ohio. MHMC is an urban academic hospital that serves as the county hospital for Cuyahoga County. The study was performed between October of 2002 and September of 2003. The study was approved by the Institutional Review Board of MHMC. All subjects provided informed consent to participate.

2.2. Subjects

We prospectively studied 505 patients and assessed their risk for OSA as determined by the Berlin Questionnaire (described below). Subjects in the asthma group were recruited consecutively from patients seen in the adult Asthma Clinics at MHMC. The diagnosis of asthma was determined by a pulmonologist specializing in asthma care, and the severity of asthma was determined by on spirometry classification. Subjects from the internal medicine group were recruited as a conve-

nience sample from the Internal Medicine Clinics at MHMC while waiting for their appointments.

2.3. Berlin Questionnaire

The Berlin Questionnaire was utilized to identify those with a high pre-test probability of OSA [16]. The Berlin Questionnaire was developed to have a self-reported questionnaire that could accurately predict the presence of sleep-disordered breathing. The questionnaire contains three categories: category 1 asks questions about snoring and witnessed apneas (one introductory question and four follow-up questions about frequency and loudness), category 2 asks questions about sleepiness and fatigue (three primary questions and one sub-question about drowsy driving), and category 3 asks one question about history of hypertension. Also included in category 3 is the presence or absence of obesity as determined by a body mass index (BMI) < or $\geqslant 30$ kg/m^2. The BMI is calculated from the patient's self-reported weight and height. Subjects are determined to be at high risk for OSA if they fulfill criteria in at least two of the three categories. Subjects were also asked to report age, gender, ethnicity, and their co-morbidities, selecting from a list of 14 relevant diagnoses.

The questionnaire has a high internal validity (Cronback correlations of 0.86 to 0.92) and has been validated in a primary care setting. For identifying individuals with an apnea–hypopnea index (AHI) >5, the questionnaire had a sensitivity of 0.86, a specificity of 0.77, and a positive predictive value of 0.89 [16]. A recent study in an outpatient cardiology practice confirmed these findings with a sensitivity of 0.86, a specificity of 0.89, and a positive predictive value of 0.97 [17].

2.4. Questionnaire distribution

Surveys were handed out to patients waiting for an appointment in either the Asthma Clinics or the Internal Medicine Clinics at MHMC. On-site staff collected the questionnaires and returned them to the sleep center for data entry. For a questionnaire to be valid and included in the analysis, all items had to be answered and the questionnaire had to be dated.

2.5. Spirometry

Spirometry was performed in all asthmatic patients. Spirometry was measured utilizing the KoKo Spirometer (Pulmonary Data Services, Inc., Louisville, CO) with a Fleisch-Type Pneumotachometer. Hankinson equations [18] were used to generate predicted ranges for parameters measured. Forced Vital Capacity (FVC) and Forced Expiratory Flow in one second (FEV1) were measured. The FEV1/FVC was calculated, and all val-