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Association of obesity and severity of acute asthma exacerbations in Filipino children

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ABSTRACT

Background: Increased body mass index (BMI) may be a risk factor for the development and severity of asthma. However, the effect of obesity on asthma exacerbations is unclear.
Objective: To examine the association of obesity and the severity of acute asthma exacerbations.
Methods: A retrospective cohort of children aged 5 to 18 years who were seen in the emergency department and admitted for acute asthma exacerbation from 2009 to 2011 was reviewed. Weight and height data to compute the BMI were taken from the medical record review. The Centers for Disease Control and Prevention BMI-for-age growth charts for boys and girls aged 2 to 20 years were used to classify underweight, normal, overweight, and obese. Severity of asthma exacerbations into mild, moderate, or severe was determined using criteria by the Global Initiative for Asthma 2010. The χ^2 test of association or the Fisher exact probability test for small samples was used to determine the association between nutritional status and severity of asthma exacerbations.
Results: Of the 303 cases reviewed, most were boys with a mean (SD) age of 10 (3.8) years. The prevalence of overweight and obese children admitted for acute asthma exacerbation was 21% and 28%, respectively. No significant difference was found in the severity of asthma exacerbations, with 82.9% of the nonobese group and 86.8% of the overweight-obese group having moderate-to-severe exacerbation (likelihood ratio, 0.879; 95% CI, 0.42–0.41; $P = .88$).
Conclusion: Our findings suggest that the severity of acute asthma exacerbations was not affected by increased BMI.

Introduction

A global increase in overweight and obese children has been seen in developed countries, with an additional 1% of children becoming overweight each year.[1] However, the prevalence of childhood obesity is also increasing rapidly in the low- and middle-income countries, such as in the Asia-Pacific region.[2] Likewise, the prevalence of childhood asthma has increased. In the United States, it has more than doubled, with an increase from 3.1% in 1980 to 7.1% in 2004[3] and even higher to 9.1% in 2007.[4] There is a parallel increase in the prevalence of obesity and asthma, 2 of the most common chronic diseases in childhood.[5,6] In addition, numerous studies have reported an association between asthma development and severity and obesity.

Obesity has been identified as a risk factor for developing asthma in several longitudinal studies in children.[7–9] with obese children with asthma having more severe disease.[10–13] Obese children were more likely to have an increased risk for use of β-agonists canisters and systemic corticosteroids,[14] significantly more intensive care unit admissions, and slower recovery compared with normal weight children counterparts.[15]

A multicenter, prospective cohort study was performed in 17 states in the United States and 2 states in Canada to determine the prevalence of obesity among children presenting to the emergency department (ED) with acute asthma. Results indicate that the prevalence of obese patients who presented with acute asthma attacks was significantly higher than those of their nonobese counterparts.[16] However, the severity of asthma attacks and its relation to body mass index (BMI) and its mechanisms still need to be investigated further. Our study therefore aimed to determine the prevalence of obesity in children 5 years and older admitted for acute asthma exacerbation in a private tertiary hospital and to examine the association between BMI and severity of their acute asthma exacerbation.

Methods

Study Design and Patients

The study retrospectively analyzed records from 2009 to 2011 of patients seen for acute asthma exacerbation in the pediatric ED of a

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tertiary care hospital and eventually admitted. Included were children aged 5 to 18 years diagnosed as having asthma by a physician as reported by the parent or guardian. Children with comorbidities and diagnoses, such as pneumonia, other active chronic respiratory diseases, chest wall abnormalities, respiratory anatomical abnormalities, and gastroesophageal reflux disease, were excluded from this study.

Data Collection

Weight and height data were all taken from the medical record review. The BMI of each patient was calculated by dividing the patient's weight in kilograms by the square of height in meters. The Centers for Disease Control and Prevention BMI-for-age growth charts for boys and girls aged 2 to 20 years were used to classify underweight (BMI for age in the fifth percentile or less), normal (BMI for age in the greater than 5th percentile but 85th percentile or less), overweight (BMI for age in the greater than 85th percentile but 95th percentile or less), and obese children (BMI for age in the greater than 95th percentile). Other data collected included medical history and family history of other atopic diseases; asthma control indicators, such as history of intensive care unit (ICU) admissions, prior intubations, and length of time since last exacerbation; and medications used for asthma.

The classification of the severity of an asthma exacerbation was determined using the table recommended by the Global Initiative for Asthma (GINA) 2010. The patients were classified as having mild, moderate, or severe asthma exacerbations.[17] Classification was dependent on the following parameters: breathlessness, number of words spoken by the patient at a time (words, phrases, or sentences), alertness, respiratory rate, use of accessory muscles, wheezing, pulse per minute, pulsus paradoxus, peak expiratory flow (PEF) after initial bronchodilator use, and oxygen saturation. The presence of at least 1 of the parameters in the highest level of severity classification determined the severity of the asthma exacerbation of the patient.

Statistical Analysis

Data were analyzed using STATA statistical software, version 10 (StataCorp, Chicago, Illinois). Frequency tables were generated to show the distribution of patients with asthma according to demographic factors (age, sex), health history (family history of asthma, personal history of atopy), asthma control indicators (previous ICU admission, medications taken before attack, length of time since last exacerbation), presence of comorbidities, clinical features (nutritional status using BMI classification, use of accessory muscles, presence of wheezes, oxygen saturation at room air, classification of severity of asthma exacerbation according to GINA guidelines), and need for intensive care.

To determine the association between nutritional status and severity of asthma exacerbations, a χ^2 test of association or a Fisher exact probability test was used for small samples when appropriate. Computation of the prevalence ratio was likewise performed. $P \leq .05$ was used as the cutoff for significance. The study was approved by the institutional review board of the hospital.

Results

We reviewed a total of 303 medical records of children seen for acute asthma exacerbations who fulfilled the inclusion and exclusion criteria. Chief concerns reported for all the ED visits were asthma attack, difficulty of breathing, or shortness of breath. There were more boys than girls, and most patients were between 5 and 10 years of age (Table 1). Almost half of the patients seen (145 [49%]) were overweight (n = 58) or obese (n = 87) (Table 1).

Consistent clinical findings as written in the medical records at the time of ED visit included respiratory rate and heart rate, use of accessory muscles, presence of wheeze, and oxygen saturation. Unfortunately, there were inconsistent recording of PEF measurements and no recording of other parameters, such as number of words spoken and presence or absence of pulsus paradoxus. Likewise, there was no information on the exact triggers of the asthma exacerbation.

Following the GINA guidelines for severity of asthma exacerbation, 214 patients (71%) were classified as having moderate exacerbation. Forty-six (15%) were classified as having a mild exacerbation and 43 (14%) as having a severe exacerbation. Only 3 patients (1%) necessitated ICU admission (Table 2). Asthma control indicators, such as length of time since last exacerbation and history of ICU admissions, were not different between normal BMI and overweight and obese patients (Table 1). No significant difference was found between the severity of asthma exacerbation of those overweight and obese patients from the children with normal BMI (Pearson $\chi^2 = 9.066$) (Table 3). Stratifying this group by age as defined by the American Academy of Pediatrics into preadolescent (5–10 years old) and adolescent (11–18 years old) yielded similar findings.

A comparison was also made between the nonobese groups (underweight and normal) and the overweight-obese groups. No significant difference was found in the severity of asthma exacerbations between the 2 groups, with 82.9% of the nonobese group being classified as having moderate to severe exacerbation vs 86.8% of the overweight-obese group (likelihood ratio, 0.879; 95% CI, 0.42–0.41; $P = .88$) (Table 4). Similarly, analyzing by different age groups (preadolescent and adolescent) did not reveal significant differences. Of these patients, 3 patients with severe exacerbation were admitted to the ICU. One of those had a normal BMI, and 2 were obese.

Discussion

The global prevalence of combined overweight and obesity has increased in all regions. Worldwide, the proportion of adults with a BMI of 25 or greater increased between 1980 and 2013 from 28.8% to 36.9% in men and from 29.8% to 38% in women. Prevalence has increased considerably in children and adolescents in developed countries; 23.8% of boys and 22.6% of girls were overweight or obese in 2013. Even in developing countries, the prevalence of overweight and obesity has also increased in children and adolescents, from 8.1% to 12.9% in 2013 for boys and from 8.4% to 13.4% in girls.[18] In fact, the World Health Organization reports that most of the world's population now live in countries where overweight and obesity kill more people than being underweight.[19]

In our group of patients presenting to the ED with acute asthma exacerbation, the obese and overweight group comprised almost half of the population. This prevalence is certainly higher than the worldwide prevalence for obesity in the general population and even higher than the general prevalence in the Philippines, where this study was conducted. The Eighth National Nutrition Survey in 2013 reveals that the prevalence of overweight among Filipino children is 5% and 9.1% among children 0 to 5 years old and 5 to 10 years old, respectively. The 2011 Global School-based Health Survey also found that approximately 13% of adolescents in the Philippines are overweight and obese.[20]

There is substantial evidence that obesity and asthma are related. Several cohort studies indicate that increased BMI has been associated with an increased incidence of asthma in children.[21–24] In prior studies that assessed the association between obesity and asthma in children, the prevalence of obesity was found to be 1.5 to 2.5 times higher in those with physician-diagnosed asthma compared with those without asthma.[16] A meta-analysis performed by Beuther et al[25] found an increased odds ratio for incident asthma of 1.92 (95% CI, 1.43–2.59) in those with obesity vs normal