

Original paper

Assessment of Asthma Severity by History and Lung Function Study in School Age Children

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Abstract

Background: The assessment of childhood asthma severity is important for the diagnosis and determining the initial level or step of the treatment of childhood asthma. It can be performed either by history alone for children less than five years old or by history and pulmonary function test for older children.

Objective: to evaluate and compare the utility of history and lung function test in the assessment of asthma severity in children

Patients and Method: Across-sectional study was conducted in Karbala teaching hospital of pediatrics, during the period from October 1, 2013 - April 30, 2014. The study included 50 children of both genders diagnosed with asthma (diagnosis made by consultant pediatrician). A questionnaire was designed for the assessment of asthma severity by history which included symptoms frequency over the preceding 4 weeks respectively. The lung function test was only done in children 6-year-old and more. All children in our study had performed lung function test.

Results: The mean age of studied group was 9.6 ± 2.5 . The result of asthma severity assessment based on history was as follow: 14/50 patients (28%) had intermittent asthma, 36/50 (72%) had persistent asthma of different degrees, mild in 11/50 (22%), moderate in 19/50 (38%) and severe persistent asthma in 6/50 (12%). While according to lung function test, 12/50 patients (24%) had intermittent asthma, 15/50 (30%) had mild persistent, 19/50 (38%) had moderate persistent and the remaining 4/50 patients (8%) had severe persistent asthma. There was no significant statistical difference in severity assessment between the two methods ($P > 0.05$).

Conclusions: Our study shows good correlation between history and lung function test regarding classification of childhood asthma severity. History is an excellent tool for the assessment of childhood asthma severity when lung functions test is unavailable or difficult to be done in younger children.

Keywords: Pulmonary function test, Childhood asthma, Asthma severity

Introduction

Asthma is a chronic inflammatory disease of the airways characterized by variable and recurring symptoms, reversible airflow obstruction and bronchospasm ⁽¹⁾. Common symptoms include wheezing, coughing, chest tightness, and shortness of breath ⁽²⁾. Its diagnosis is usually based on the patter of symptoms, response to therapy over time and lung function test ⁽³⁾

The prevalence of childhood asthma in Iraq is 16.4% in school age children ⁽⁴⁾. Establishing a diagnosis of asthma involves a careful process of history taking, physical examination, and diagnostic studies ⁽⁵⁾. Updated guidelines from the National Asthma Education and Prevention Program highlight the importance of correctly diagnosing asthma, by establishing the following⁽⁶⁾:

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- Episodic symptoms of airflow obstruction are present
- Airflow obstruction or symptoms are at least partially reversible
- Exclusion of alternative diagnoses

There is currently no precise test with the diagnosis typically based on the pattern of symptoms and response to therapy over time^(7, 8). The diagnosis of asthma should be suspected if there is a history of: recurrent wheezing, coughing or difficulty in breathing and these symptoms occur or worsen due to exercise, viral infections, allergens or air pollution. Spirometry is then used to confirm the diagnosis⁽¹⁾. In children under the age of six years the diagnosis is more difficult as they are too young for spirometry⁽⁹⁾.

The medical history and physical examination may suggest the diagnosis of asthma. However, to establish the diagnosis and to facilitate assessment of severity, one should demonstrate, when possible, reversible airflow obstruction using spirometry⁽¹⁰⁾.

The National Asthma Education and Prevention Program (NAEPP) expert panel recommends that spirometry be performed in patients older than five years if a diagnosis of asthma is being considered⁽¹⁰⁾. If the forced expiratory volume in one second (FEV₁) measured by this technique improves more than 12% following administration of a bronchodilator such as salbutamol, this is supportive of the diagnosis⁽⁸⁾. Spirometry measurements include forced vital capacity (FVC) and the (FEV₁). Airflow obstruction is defined as FEV₁ reduced to less than 80 percent predicted and an FEV₁/FVC ratio of less than 0.85 (85 %). Reference values are based on age, height, sex, and race⁽¹¹⁾. FEV₁/FVC ratio appears to be a more sensitive measure of impairment than FEV₁, whereas FEV₁ may be a more useful measure of risk for future exacerbations⁽¹²⁾. Management of asthma should have the following components: Assessment and monitoring of disease

activity. Education to enhance patient and family knowledge and skills for self-management.

Identification and management of precipitating factors and comorbid conditions that worsen asthma. Appropriate selection of medications to address the patient's needs⁽¹³⁾. Asthma severity is the intrinsic intensity of disease, and assessment is generally most accurate in patients not receiving controller therapy. Hence, assessing asthma severity directs the initial level of therapy. The two general categories are intermittent asthma and persistent asthma, the latter being further subdivided into mild, moderate, and severe. In contrast, asthma control refers to the degree to which symptoms, ongoing functional impairments, and risk of adverse events are minimized, and goals of therapy are met⁽¹³⁾.

Aims of the Study

To evaluate the utility of history and lung function test in the assessment of asthma severity in children.

Patients and Methods

Study design:

This cross-sectional study was conducted in Karbala teaching hospital for children, during the period from October 1, 2013 - April 30, 2014.

Patients:

This study included 50 children of both genders diagnosed with asthma (diagnosis made by consultant pediatrician) recruited from asthma out patient's clinic of the Karbala Teaching hospital of Pediatrics.

Exclusion criteria

- Patient with Cardiovascular disease.
- Patient with Chronic disease like chronic renal failure, chronic lung disease, diabetes mellitus etc.
- Patient on controller therapy.
- Patient aged < 6 years.

Data collection tools:

Data were collected by using a pre-structured questionnaire which include the following items:

A. Socio-demographic characteristics:

Name, age, date of birth, gender and.

B. Anthropometric measurements:

Height, weight and body mass index

C. Assessment by history:- Symptoms over the past four weeks were assessed including daytime symptoms, nighttime symptoms, use of short acting inhaled beta agonists to relieve symptoms, and difficulty in performing normal activities and exercise as seen in table (1).

D. Pulmonary function test:

Pulmonary function test was done by using Spirolab (III) spirometer with disposable turbine which measure FEV₁ % predicted and FEV₁/FVC ratio and then classified according to the reading as showing in table (1). For analytical purposes, we chose the best (FEV₁) and (FVC/FEV₁) ratio from the spirometric session for each study participant.

Results

A total of 50 patients were enrolled in this study with a mean age of 9.4± 2.5 (range: 6 – 16) years. Males were 33/50 (66%) and females were 17/50 (34%).

Asthma severity

The distribution of asthma severity documented according to history and lung function tests (LFT) is shown in (Table 2); according to history, 14 patients (28%) had intermittent asthma while 36 (72%) had persistent asthma of different degrees, mild in 11 (22%), moderate in 19 (38%) and severe persistent asthma in 6 (12%). According to LFT, 12 patients (24%) had intermittent asthma, 15 (30%) mild persistent, 19 (38%) moderate persistent and the remaining 4 patients (8%) had severe persistent asthma; however, the differences in classification of asthma severity documented by history or LFT were statistically insignificant ($P > 0.05$).

Furthermore, cross-tabulation of asthma severity according to history and LFT was performed and the agreement between them was assessed using kappa statistics. The findings of this analysis are shown in (Table 3), it had been found that history and LFT had an agreement percentage of 82% (kappa= 0.64, agreement% = 82%), where the history agreed the LFT in classification of 10 intermittent cases, 10 mild persistent cases, 16 moderate persistent cases and 4 severe persistent asthma cases, i.e. the total agreement in classification of asthma severity of 40 cases.

Discussion

Assessment of childhood asthma severity was done by history and lung function test. In assessing childhood asthma severity, the history consists of an assessment of the patient's recent symptom frequency (day time and night time), SABA usage for quick relief and ability to engage in normal or desired activities.

The lung function test done only in children 5-year-old and more as the assessments of childhood asthma severity in children less than 5 year depend only on history. So, in this study we compared between the history and lung function test in determining asthma severity.

The update of the NAEPP guidelines did not modify the severity classification other groups have modified the NAEPP guidelines in an attempt to expand measures of severity to include severity assessment on the basis of the type of current treatment and the presence of symptoms while on treatment⁽¹⁵⁾.

The current study which conducted during a period of seven months duration at Karbala teaching hospital for children included 50 asthmatic patients with different degrees of severity aiming to assess severity of asthma according to history and lung function test.

Table 1. Assessment of asthma severity and initiation of therapy in children by National Asthma Education and Prevention Program (14)

Components of severity	Classification of asthma severity			
	Intermittent	Persistent		
		Mild	Moderate	Severe
Daytime symptoms	≤2 days/wk.	>2 days/wk. but not daily	Daily	Throughout the day
Nighttime awakenings:				
Age 0-4 yr.	0	1-2/month	3-4/month	>1/wk.
Age ≥5 yr.	≤2/month	3-4/month	>1/wk. but not nightly	Often 7/wk.
SABA use for symptoms	≤2 days/wk.	>2 days/wk. but not daily	Daily	Several times daily
Interference with normal activity	None	Minor limitation	Some limitation	Extreme limitation
Lung function (≥ 5 yr.):				
FEV ₁ % predicted	>80	>80	60-80	<60
FEV ₁ /FVC ratio	>0.85	>0.8	0.75-0.8	<0.75
Recommended step for initiating therapy				
All ages	Step 1	Step 2		
Age 0-4 yr.			Step 3	Step 3
Age ≥ 5 yr.			Step 3, medium-dose ICS option	Step 3, or Step 4

Table 2. Distribution of Asthma severity

Severity		History		LFT		P.value
		No.	%	No.	%	
Intermittent		14	28.0	12	24.0	0.82
Persistent	Mild	11	22.0	15	30.0	0.49
	Moderate	19	38.0	19	38.0	0.84
	Severe	6	12.0	4	8.0	0.74
Total		50	100.0	50	100.0	-

Table 3. Cross-tabulation for the agreement between history and lung function study in detection of asthma severity

Severity by History		Severity by Lung function study			Total	
		Intermittent	Persistent			
			Mild	Moderate		Sever
Intermittent		10	4	0	0	14
Persistent	Mild	0	10	1	0	11
	Moderate	2	1	16	0	19
	Severe	0	0	2	4	6
Total		12	15	19	4	50

Kappa= 0.64, agreement% = 82%

Finding of our study indicates an agreement between the classification of asthma severity by history and lung function test of 82%. Previous studies support our finding; In a study conducted in USA by James W. Stout et al for classification of asthma severity. Data were studied from children enrolled in 2 multicenter studies: phase 1 of the National Cooperative Inner-City Asthma

Study (1992-1994) (cohort 1) and the Inner-City Asthma Study (1998-2001) (cohort 2), cohort 1 included 257 children, and cohort 2 included 383 children. The mean age for cohort 1 was 8.5 years and for cohort 2 was 9.5 years, found that two third of agreement between history and lung function test in the classification of childhood asthma severity (16).

Another study was conducted by Leonard B. Bacharier et al found mismatch in classification of childhood asthma based on history and lung function test. Two hundred nineteen children were enrolled into the study. The mean age of study participants was 10.1 ± 3.4 years. Fifty-five percent were younger than 10 years of age (17). Probably this mismatch because the majority of patients (75%) were receiving controller therapy.

because of the higher percent of agreement between classification of childhood asthma severity based on history and lung function test therefore in practice a pediatrician could depend on history for classification of childhood asthma severity particularly in young age group when the application of lung function test is difficult because children in young age group could not perform the test correctly and the finding will be less precise.

From other point of view history based classification will be an excellent tool for assessment childhood asthma severity when the spirometer is unavailable or inapplicable.

Conclusions

There was a high agreement rate between history and lung function test in classification of childhood asthma severity. History is an excellent tool for the assessment of childhood asthma severity when the lung functions test is unavailable.

Recommendation

- 1- Using history based classification for the assessment of childhood asthma severity when the lung function test is unavailable or inapplicable.
- 2- Further study with large sample size and larger duration are suggested.

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