Correlation of clinical score to pulmonary function and oxygen saturation in children with asthma attack

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ABSTRACT

Background: The aim of this study is to demonstrate the importance of the relation between clinical score, pulse oximetry and spirometric tests in an asthma attack.

Methods: In this randomized, double blind, observational study, 110 children (age 2-15 years) with an asthma attack who were admitted to emergency room were evaluated. Patient history, physical examination, clinical score and oxygen saturation were recorded in all patients; however pulmonary function tests were obtained only in 54 children who were over 5 years of age. The clinical score was derived from respiratory rate, wheezing, dyspnea and retractions.

Results: Both oxygen saturation and spirometric tests were found to be significantly correlated with the clinical score in children.

Conclusion: The clinical score could be used for assessing the severity of the asthma attack particularly in developing countries where laboratory facilities are not available or pulmonary function tests are not feasible.

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INTRODUCTION

Acute asthma is the most common medical emergency in children and is responsible for increased hospitalization and death rates in several developing countries. In the emergency room setting, the most critical issue facing the attending physician is, deciding the adequacy of outpatient therapy of acute asthma, or when hospitalization is indicated. Traditionally, this decision is used to be made according to the clinical history, physical examination, laboratory results and response to therapy of the patient[1-6]. Several clinical scoring systems are presented for simplification of this. Among these some are not feasible as they contain parameters (pulsus paradoxus or inspiratory:expiratory ratio) which are difficult to be assessed by other personnel rather than the physician particularly in young children or those require active use of a monitoring device such as peak flow meter or oxygen saturation[7,8]. However, the clinical score we used is derived from the observation of physical signs by different care givers (physicians, nurses, respiratory therapists) in asthmatic children (table I)[9].

Pulse oximetry on the other hand, is a widely used, noninvasive instrument for monitoring oxygen saturation. Its ease of performance has led to its widespread use in intensive care units and in the management of a variety of respiratory disorders[7]. Although obtaining spirometric test might be difficult in infants and young children who are excessively active, irritable, or uncooperative the forced expiratory volume in

Table I

Clinical score[9]

	0 Point	1 Point	2 Point	3 Point
Respiratory rate (Breath/min)				
2-3 yrs	_	≤ 34	35-39	≥ 40
4-5 yrs		≤ 30	31-35	≥ 36
6-12 yrs		≤ 26	27-30	≥ 31
> 12 yrs		≤ 23	24-27	≥ 28
Wheezing	None	End-expiratory wheezing	Expiratory Wheezing	Insp + Exp wheezing, or diminished breath sound or both
Retractions	None	Intercostal	Intercostal + Substernal	Intercostal, Substernal, + Supraclavicular
Dyspnea				
2-4 yrs	Normal feeding, vocalizations, and activity	1 of the following: Decreased appetite, increased coughing after play	2 of the following: Decreased appetite, increased coughing after play	Stop eating or drinking, stops playing, or drowsy or confused
≥ 5 yrs	Counts to ≥ 10 in one breath	Counts to 7-9 in one breath	Counts to 4-6 in one breath	Counts to ≤ 3 in one breath

1 sec (FEV_1) correlates well with the severity of obstructive diseases in children over 5 years of age[8].

The purpose of this study was to investigate the value of clinical signs in children with acute asthma and whether the information obtained would be of particular help to physicians who do not have ease of access to pulmonary function and oxygen saturation (SpO_2) testing in the evaluation of such patients.

MATERIALS AND METHODS

We conducted a randomized double blind, observational study in 110 children (2-15 years of age) who were admitted to the Pediatric Emergency Room in more than one attack of acute bronchial asthma requiring bronchodilator therapy within 6 months of entry in the study. Children with a significant acute or chronic disease such as pneumonia, croup, pertussis, foreign body aspiration and cardiac congenital malformations were excluded. The study was approved by the Ethics Committee, and informed written consent from the parents was obtained.

The severity of acute asthma attack was evaluated by a physician using the clinical score which included respiratory rate, wheezing, dyspnea and retractions with the child standing, not crying, without fever and breathing room air only (table I)[9]. Simultaneously, a nurse, who was unaware of the patient's clinical score, measured SpO_2 with a pulse oximeter (Kontron Minimon 7138 Plus) using a pediatric probe placed on the finger. The mean SpO_2 was recorded after three measurements. Pulmonary function test (especially FEV_1) with a spirometer (MIR, Sensor Medics 2130, USA) was only performed in children over 5 years of age. We recorded gender and age and measured height and weight of each children before spirometry. We have used Morris Polgar reference oxymetry values for height and weight.

Treatment was planned according to the emergency room asthma guidelines (GINA) and simply consisted of oxygen and steroid besides nebulized salbutamol[10]. We have also treated moderate and severe attack of asthma patients with oxygen, bronchodilator and steroid therapy. Patients were reevaluated at hourly intervals by the same clinical score, SpO_2 and FEV_1. The maximal duration of patients in the emergency room was 6 hours and all patients with a clinical score over 7 (n: 44) on admission needed hospitalization.

Data were analyzed by SPSS-10 program and the results were shown as mean and standard deviation (mean ± SD). The relation between the clinical score, FEV_1 and SpO_2 were assessed by Pearson correlation analysis and $p < 0.05$ was accepted as the significance level.