Clinical Predictors of Intensive Care Unit Admission for Asthmatic Children

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Abstract

Introduction

Children with severe asthma attack are a challenging group of patients who could be difficult to treat and leading to significant morbidity and mortality. Asthma attack severity is qualitatively estimated as mild, moderate and severe attacks and respiratory failure based on conditions such as respiration status, feeling of dyspnea, and the degree of unconsciousness. Part of which are subjective rather than objective. We investigated clinical findings as predictors of severe attack and probable requirement for Pediatric Intensive Care Unit (PICU) admission.

Materials and Methods

In a cross sectional and analytical study, 120 patients with asthma attack were enrolled from April 2010 to April 2014 (80 admitted in the pediatric ward and 40 in Pediatric Intensive Care Unit). Predictors of PICU admission were investigated regarding to initial Heart Rate (HR), Respiratory Rate (RR), Oxygen Saturation in Arterial Blood (SaO2) and Partial Pressure of Carbon Dioxide in Arterial Blood (PaCo2) and clinically evident cyanosis.

Results

Initial heart rate (P=0.02), respiratory rate (P=0.03), Arterial oxygen saturation (P=0.02) and PaCo2 (P=0.03) and clinically evident cyanosis were significantly different in two groups (Ward admitted and PICU admitted).

Conclusion

There was a significant correlation between initial vital sign and blood gas analysis suggesting usefulness of these factors as predictors of severe asthma attack and subsequent clinical course.

Key Words: Asthma attack, Children, Pediatric Intensive Care Unit, Predictor factors.

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Introduction

Asthma in children is chronic, persistent disorder characterized by airway inflammation and episodic airflow obstructions in response to specific triggers (1, 2). Children with severe asthma are a challenging group of patients who could be difficult to treat. Global Initiative for Asthma (GINA) emphasize the importance of assessing asthma severity in children before initiation of therapy. Severe asthma is defined primarily by lung function abnormalities, persistent symptoms and exacerbations despite appropriate therapy (3, 4).

Asthma attack severity is qualitatively estimated as mild, moderate, and severe attacks and respiratory failure based on conditions such as respiration status, feeling of dyspnea, and the degree of unconsciousness. Part of which are subjective rather than objective. Modified Pulmonary Index Score (mPIS) is a quantitative method of evaluating respiratory conditions in asthmatic subjects that was proposed by Carroll et al. This method consists of 6 evaluation items, which are important for the assessment of dyspnea and are relatively easy to assess in clinical practice, namely heart rate, respiratory rate, accessory muscle use, inspiratory to expiratory flow ratio, degree of wheezing, and oxygen saturation in room air(5).

Takeshi Koga et al. investigated the clinical usefulness of evaluating mPIS for severe exacerbation in asthmatic children requiring hospitalization and concluded that mPIS was useful for predicting the clinical course after hospitalization (6). In current study we investigated clinical findings as predictors of severe attack and probable requirement for PICU admission children.

Materials and Methods

A cross-sectional analytical study was conducted in the referral pediatric hospital (Children Hospital) in Tabriz, North-West of Iran, over a period of 4 years from April 2010 to April 2014.

120 patients with ages 4-14 years old with asthma attack were enrolled in study consecutively (80 admitted in the pediatric ward and 40 in pediatric intensive care unit). Patients were eligible for inclusion if they had a history of asthma or if their primary admission diagnosis was asthma. Attack severity was assessed according to GINA categorization. Predictors of PICU admission were investigated regarding to initial heart rate (HR), respiratory rate (RR), Arterial Oxygen Saturation (SaO_2) and $PaCo_2$ and clinically evident cyanosis. The patient's demographic characteristics and history of previous admission was recorded.

Data were analyzed using the SPSS, version 17.0. Quantitative data were presented as mean± Standard deviation (SD), while qualitative data were demonstrated as frequency and percent (%). P-value <0.05 was considered statistically significant. The study was approved by ethics committee of Pediatric Health Research Center in Tabriz University of Medical Sciences.

Results

120 patients were enrolled in this study. Age and gender between two groups (PICU and ward admitted) were not statistically different (Table.1). Heart rate, respiratory rate and cyanosis were the clinical findings investigated and the difference between two groups was significant (P<0.05). Blood gas analysis revealed significant difference in pco2 level between two groups (Table. 2).

Table 1: patient's base-line characteristics

Characteristics	PICU admitted	Normal ward admitted	P-value
Age (months)	36.2±24.33	38.3±19.44	0.08
Gender (F/M)	46/54	49/51	0.09

Table 2: The results of comparison between two groups

Characteristics	PICU admitted	Normal ward admitted	P-value
HR	110±12	85±17	0.02
RR	70±16.32	55±11.44	0.03
SaO_2	81±16.32	90±5.27	0.02
$PaCo_2$	55±13.33	40±10.43	0.03
Cyanosis	100%	0%	0.003
Previous PICU admission	12%	0%	0.004
Treatment compliance	33%	62%	0.02

Abbreviation: HR: Heart rate, RR: Respiratory rate, BPM: Beat per minute, SaO_2: Arterial saturation of Oxygen, PaO_2: Arterial Carbon Dioxide Content.

Discussion

Asthma is the most common chronic disease of childhood and leading cause of morbidity from chronic disease as measured by school absences, emergency department visits and hospitalization (7). Severe asthma attack can lead to childhood morbidity and mortality. Among the studies considering age as admission factor, eight studies which were conducted between 1994 and 2012 found positive association between younger age and higher readmission rate (8-15). But in our study age was not a risk factor for more severe asthma attacks between two groups (admitted to normal ward and PICU).

Female gender was pronounced as a risk factor for hospitalization and readmission in studies conducted by Mitchell et al. (14) and Minkovitz et al. (16). In our study there was not significant gender dominancy between two groups.

Previous admissions to emergency department and PICU were also linked to higher hospital readmission in studies by Alshehri et al. (17), Lasmar et al. (12), and Visitsunthorn et al. (18). In our study previous admission rate to PICU was higher in group admitted to PICU and the

this difference was statistically significant (p<0.004).

Clinically predictors of severe attack in our study were initial heart rate, respiratory rate and oxygen saturation in room air which was in accordance with Carroll and

Takeshi's studies (with p- value= 0.02, 0.03 and 0.02 respectively) (5, 6).

Conclusion

There was a significant correlation between initial vital sign, blood gas analysis and hospitalization course. These findings were investigated by modified pulmonary index score in similar studies. It indicates usefulness of these factors as predictors of severe asthma attack and subsequent clinical course. Age and female gender were not risk factors for severe attack in our study.

Conflict of interest: None.

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