

Risk Factors Leading to Hospital Admission in Iranian Asthmatic Children

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Key Words

Asthma • Risk factors • Iran

Abstract

Background: Asthma is one of the most common chronic diseases in the world, leading to an increased rate of hospitalization. We performed this study to better understand the factors leading to admission among asthmatic children.

Methods: We performed a study among asthmatic children in a referral hospital for asthma and allergy in Tehran. Sixty-three cases were selected from asthmatic children admitted to the emergency room (ER) who still had an indication for ward or intensive care unit admission after primary treatment. Our control group was the asthmatic children discharged after primary treatment and patients who were referred to the asthma and allergy clinic (63 patients). Data were obtained by structured questionnaires filled out during clinical interviews. **Results:** There was a significant difference in mean age (5 years for cases vs. 6 years for controls; $p = 0.049$), personal and familial allergic history (69.8 and 57.1% for cases vs. 34.9 and 36.5% for controls; $p < 0.01$ and $p = 0.02$, respectively), history of recent respiratory infections (79.4% for cases vs. 49.2% for controls; $p < 0.01$), hospitalization history due to asthma (57.1% for cases vs. 23.8% for controls; $p < 0.01$) and regular use of inhaled corticosteroid (66.7% for cases vs. 33.3% for controls; $p < 0.01$). **Conclusions:** Our findings confirm most previous observations, suggesting that recent respiratory infections, hospitaliza-

tion, personal or familial allergy, disease severity and lower ages are important factors leading to hospitalization. We also found that regular clinical follow-up, regular use of inhaled corticosteroids, higher IgE levels and O_2 saturation may lower the probability of hospitalization during asthmatic attacks.

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Introduction

Asthma is a chronic inflammatory disorder of the respiratory airways which may cause episodic cough, wheeze, shortness of breath, and chest tightness [1]. It is estimated that around 300 million people suffer from asthma globally and there may be an additional 100 million people with asthma by 2025 [2]. Although the information about mortality of asthma is unreliable in different countries, it is believed that asthma accounts for about 250,000 deaths per year worldwide [2]. Asthma is a leading cause of hospitalization among children [4–7]. Asthma, together with infections, contributes one half of all hospitalizations in children 1–4 years of age and one third of hospitalizations in children 5–9 years of age [8].

The number of disability-adjusted life years (DALY) currently lost due to asthma worldwide has been estimated to be about 15 million per year [2]. Worldwide, asthma accounts for around 1% of all DALYs lost [2]. Childhood asthma accounts for many lost school days and may de-

prive the affected children of both academic achievement and social interaction.

Understanding of hospitalization risk factors among asthmatic children, especially the modifiable ones, would help to decrease pediatric hospitalizations and loss of health care resources. Some factors have been referred to as hospitalization risk factors in previous studies [9–34]. Severity of the disease is one of the most important factors, referred to as hospitalization risk factor among asthmatic patients [3, 9]. History of prior hospitalizations or prior emergency room (ER) admissions are also mentioned as risk factors in multiple studies [10, 11]. Recent use of corticosteroids in some studies was considered as a hospitalization risk factor [12] and in others as a preventive factor [13].

Many studies have been done to identify the hospitalization risk factors among asthmatic children in Western countries, but there were only a few from the Middle East. Most of the previous studies were retrospective with a limited number of risk factors. At the same time the findings are mostly restricted to western populations. We hereby present a prospective case-control study on Iranian asthmatic patients, describing risk factors that affect asthmatic children's hospitalization.

Material and Methods

Patients

We arranged a prospective, case-control study. Sixty-three asthmatic children aged 0–12 years diagnosed at Children's Medical Center during 2004–2005 were selected as the subjects of this study. The cases were selected from children admitted to the ER due to asthma who still needed intensive care after resuscitation and primary treatment. Inclusion criteria were: (1) insufficient response to primary treatment; (2) peak expiratory flow rate <70%, and (3) near to respiratory failure signs and symptoms including confusion, $PO_2 < 60$ mm Hg, $PCO_2 > 45$ mm Hg. The control group consisted of 63 asthmatic children aged 1–15 years, discharged after primary treatment or patients with a stable medical status regularly visited at the asthma clinic.

Methods

A five-page questionnaire was designed to collect clinical and demographic data including history of allergic disease, recent respiratory infection, history of hospital admissions including ER admission, ICU admission, intubations, and family history for asthma or allergic diseases, parents smoking, drug history (corticosteroids, bronchodilators), disease severity, clinical examination and radiological or lab data, socioeconomic status and living place characteristics. Interviews were done by a physician unaware of case selection, mostly with patients' guardians. Written informed consents were obtained. Data underwent statistical analysis with t test, Kruskal-Wallis or ANOVA, and χ^2 .

Table 1. Prevalence of our variables among cases and controls

	Control	Case	p value	Odds ratio
Male	43	41	0.7	–
Female	20	22	–	–
Mean age	6	5	0.04	–
Mean age at onset	3.7	3	–	–
Attending day care	17	8	0.04	0.46
Prior hospitalization	15	36	<0.01	4.19
Prior ER admission	19	16	0.513	0.75
Recent respiratory infection	31	50	<0.01	2.7
Allergic history	22	44	<0.01	0.22
Food allergy	13	9	0.34	0.61
Atopic dermatitis	10	5	0.15	0.45
Family history of allergy	23	36	0.02	0.43
Allergic rhinitis	24	6	<0.01	0.16
Chronic sinusitis	11	2	<0.01	0.14
GE reflux	3	9	0.1	3.2
Mean serum IgE	333	59	0.03	–
Mean O_2 saturation	96.20%	89.70%	0.015	–
Prior allergy clinic admission	17	11	0.17	0.56
Formula milk	6	5	–	0.8
Corticosteroid spray	42	21	<0.01	0.25
β -agonist spray	45	39	0.4	0.66
Smoker parents	10	7	0.212	0.7
History of preterm labor	8	7	0.4	–
Use of formula milk	5	6	2.3	–
Pet owners	6	4	0.2	2.2

ER = Emergency Room; GE = gastroesophageal.

Results

The prevalence of variables among the cases and controls in our study is shown in table 1. Mean age of cases was 5 (4.6 ± 2.9) years (0–12) and of controls 6 (5.7 ± 3.2) years (1–15). Our cases were significantly younger than our controls ($p = 0.049$). Female to male ratio was 0.54 and 0.47 in cases and controls, respectively. There was no significant sex difference between the two groups ($p = 0.7$). The mean age at onset of disease symptoms was 3 and 3.7 years in cases and controls, respectively. First asthma attack occurred mostly in autumn in both cases (48.7%) and controls (44.7%). We had 7 (11.1%) and 12 (19%) smoker parents among cases and controls, respectively ($p = 0.212$). Children in the case group were less likely to attend day care centers in comparison to the control group (12.7% against 27%; $p = 0.04$; fig. 1). The socioeconomic status among patients was low in 14 (33.3%), moderate in 25 (59.5%) and high in 3 (7.1%) while in the control group, these rates were 16 (27.6%),

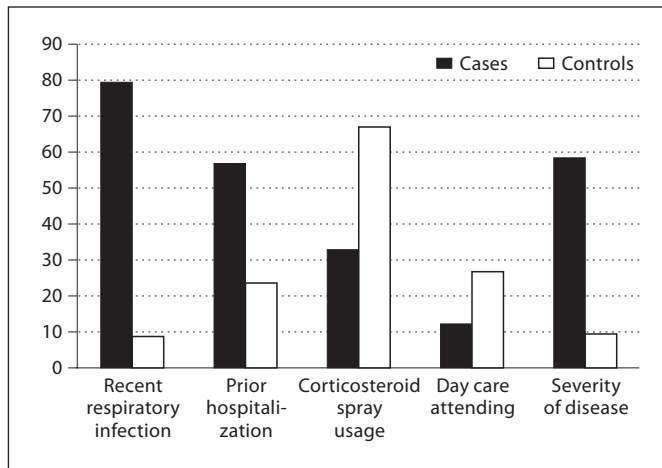


Fig. 1. Prevalence of recent respiratory infection, prior hospitalization, corticosteroid spray usage, day care attending and severity of disease among our cases and controls.

29 (50%) and 13 (22%), respectively ($p = 0.2$). Eight cases and 7 controls had a history of preterm labor, 5 cases and 6 controls were on formula milk in early childhood, all of our patients had up-to-date history of childhood vaccination and 6 cases and 4 controls were pet owners. Thirty-seven (58.7%) patients in the case group and 6 patients (9.5%) in the control group had severe or moderate persistent asthma. There was a significant difference between severity of disease in our cases and controls ($p < 0.01$). Allergic history was significantly lower in controls (34.9%) and in their families (36.5%), in comparison with cases (69.8%) and their families (57.1%; $p < 0.01$ and $p = 0.02$, respectively). There was no significant difference in the occurrence of allergies and atopia between the two groups. Mean serum IgE levels were lower (59 $\mu\text{g/dl}$) in the case group in comparison with the control group (333 $\mu\text{g/dl}$) ($p = 0.03$). Cases were more likely affected by recent respiratory infections than controls (79.4% against 9.2%; $p < 0.01$; fig. 1). Previous asthma related ER admission was not significantly different between cases and controls (25.4 and 30.6%, respectively; $p = 0.513$). There was also more asthma related prior hospitalization history among cases (57.1%) than in controls (23.8%; $p < 0.01$; fig. 1).

Inhaled corticosteroid were used significantly more frequently in controls (66.7%) than in cases (33.3%; $p < 0.01$; fig. 1), but there was not any significant relationship between use of inhaled β -agonist, oral corticosteroids or sodium-chromolin and hospitalization of asthmatic children. Mean O_2 saturation was lower in cases (89.5%) than

in controls (96.2%; $p = 0.015$), and no significant difference was found between the two groups in chest X-ray, skin prick test and spirometry results ($p > 0.5$ for all).

Discussion

Asthma affects patients regardless of gender, race or age. However, hospitalization may be influenced by demographic factors. For instance, young age is defined as a risk factor associated with hospitalization in some studies [16, 26–28]. Sex has been variably suggested as an associated factor [9, 16, 26–29]; however, our results showed an equal ratio between males and females. Mean age and mean age at disease onset were higher in controls.

According to our results there is a strong relationship between severity of disease and asthmatic children hospitalization, which is congruent with earlier studies in which severity of symptoms and treatment intensity (as disease severity indicators) were defined as hospitalization risk factors [3, 9, 14, 29, 31, 32]. We also confirmed previous findings that identified history of prior asthma-related hospitalization as a predictor for hospitalization [11–13].

Although we did not find any significant relationship between food allergy or atopic dermatitis and hospitalization, as well as previous studies [19, 20, 31], we found a general allergy history in patients and their families as a risk factor. The mean serum IgE was significantly higher in the controls. Regarding the higher allergic diseases in the case group, serum IgE is not the sole indicator of asthma and in more severe cases mechanisms other than classical allergy may play a role.

In some studies, previous attendance to allergy clinics were shown to have some preventive effect [18, 21], but we did not find any significant correlation. In our patients attendance to day care centers had a preventive effect, and this is congruent with the hygiene hypothesis and other studies [10, 24, 33, 34]. Although day care centers may increase the risk of infection among children, exposure to natural antigens from early childhood may have some regulatory effect on the immune system.

Unlike a few previous reports [10], no relationship was seen between parental smoking and children's hospitalization in our study. This may be due to some confounding elements in data collecting or due to the fact that parental smoking is not necessarily equal to indoor smoking.

We found that inhaled corticosteroid prophylaxis is effective in controlling the symptoms and reduces hospi-

talization, as addressed before [13, 22]. In some studies [13] sodium-chromolin is referred to as preventive factor, but in others [23] as risk factor for hospitalization since use of chromolin could be an indicator of disease severity. We had one case and one control using chromolin so we did not find any relationship.

Attacks occurred mostly in autumn. Enhanced prevalence of viral respiratory infections in autumn may play a role and it also suggests that indoor pollutants contribute to poorer asthma outcomes more importantly. However, outdoor allergens such as pollens, spores of fungi and moulds may also play a role in asthma. According to previous studies performed in Iran the prevalence of aeroallergens was identified as mites (18–89.74%), cockroaches (25–29%), feathers (20–70.29%) and moulds (8.3–65.08%) [35–38].

In summary, our findings confirm and extend most previous observations. History of recent respiratory infections, prior hospitalization, allergic history in patients and their families, disease severity, and lower ages are important factors leading to hospitalization in asthmatic children. We suggest that diagnosis and treatment of al-

lergic disease should be performed at early ages, especially in families with a positive history of allergy and asthma. Moreover, these families may also benefit from extended vaccination. We also found that attending day-care centers, regular use of inhaled corticosteroids, higher IgE levels and higher O₂ saturation in ER may lower the probability of hospitalization among asthmatic children presenting to ER for asthmatic attack. We think that usage of inhaled corticosteroids, with proper indications and under a physician's supervision, may decrease the risk of hospitalization in asthmatic children. Although our findings support the hygiene hypothesis, we believe that more studies should be performed in this field.

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