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Original Research Article

Factors affecting readmission for asthma exacerbation in children attending Alexandria university children-hospital

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ABSTRACT

Background: The admission rate for bronchial asthma has increased dramatically all over the world. This increase in admission influences the children's quality of life in addition to health care cost. Objective of the study was to identify the risk factors for readmission because of acute asthmatic attacks.
Methods: Case control study applied on asthmatic children admitted because of acute asthma attacks attending emergency room, paediatric intensive care unit and inpatient wards of Alexandria university children's hospital, Alexandria, Egypt in the period from September 2016 to July 2017. The study group was subdivided into 2 groups; group (A) readmitted within one year from first admission and group (B) firstly admitted.
Results: The mean age in group (A) and (B) was 9.09±3.98 and 8.65±4.01 respectively. Males were more than females in both groups, and no sex differentiation effects on readmission. The duration of the disease in readmitted group ranged from 1-8 years, it was a risk factor for acute asthma readmission. Viral infection, exercise and dust were risk factors for acute asthma exacerbation readmission. Disease severity was found to have a higher percentage of hospitalization; cases with severe and moderate bronchial asthma compared to mild cases. Readmitted patients had more sleep disturbance and lack of school attendance. Readmitted patients were less adherent to treatment.
Conclusions: Duration of the disease, viral infections, common cold, dust and exercise are risk factors for acute asthma readmission. Severity of the disease and adherence to medications affect acute asthma readmission.

Keywords: Acute asthma attacks. Asthma triggers, Controller medication, Children, Egypt

INTRODUCTION

Asthma is a serious global health problem with a huge social and economic burden.[1]

The increasing prevalence of childhood asthma in the developed world is a cause for great concern. Much research is currently being carried on aiming to identify possible causes for this occurrence.[2]

The most recent revised global estimate of asthma proposes that as many as 334 million people have asthma with increasing burden of disability.[3]

In order to improve management of asthma it is important to definitely understand the reasons of exacerbations leading to hospital admission which have the possibility for intervention.[4] There have been great advancement in medical therapy to prevent the aggravation of asthma symptoms, including improvement in understanding the aetiology of asthma, detection of risk factors for asthma

exacerbations and encouraging the benefits of writing action plans.[5]

Acute exacerbations is still a source of considerable morbidity for patient and financial burden for healthcare systems.[6] Because hospitalizations account for a large proportion of direct paediatric costs, measures aimed at improving care to reduce hospital admission is taken. These procedures included; accurate diagnosis and assessment of disease severity, proper medical intervention and follow-up, and programs constructed to teach patients and their parents how to deal with asthma. Moreover, patient must be trained to accept the importance of adhering to prescribed drugs and avoiding predisposing factors to decrease number of acute attacks.[7]

In asthma control programmes it is importance to differentiate between newly admitted asthmatic patients and those with repeated history of hospitalizations. Children with repeated hospitalizations for asthma may be different qualitatively from children with a single admission for asthma, with respect to: disease severity, contact with preventive care, or exposure to environmental pollutants. Therefore differentiation between the two types of admission patterns is of value.[8]

Hospital admission is an important risk factor for death from asthma exacerbation, together with the high cost that asthma brings upon the society as a result of hospital readmissions. So far, little is known about the exact causes of acute asthma exacerbations resulting in hospital readmission. Knowing of the possibly adjustable risk factors is mandatory for the structuring of strategies to prevent or at least decrease readmissions. This motivated us to carry out this work.

Aim of the study

Is to identify the risk factors for readmission because of acute asthmatic attacks.

METHODS

Case control study carried on one hundred asthmatic patients aged 14 years or less, who were selected from the emergency department, inpatient ward and (PICU) of Alexandria university children's hospital in the period from September 2016 to July 2017. The patients were subdivided into 2 equal groups, the first group, included asthmatic children who were readmitted within one year from first admission (group A) and the other group of patients were admitted for the first time (group B) due to acute asthmatic attacks which were severe or not improved after 3 doses of bronchodilator nebulization, The factors that might affect readmission were evaluated.

The data was collected by questionnaire that fulfilled the following data: age, sex, housing conditions, socio-economic status, family history of allergic disease (allergic rhinitis, conjunctivitis and skin allergy and food allergy), duration of the disease, effect on school attendance and sleep disturbance, compliance and adherence to prescribed treatment and regular follow up, previous PICU admission.[9] The level of asthma control was classified according to the Global of Initiative for Asthma (GINA) guideline.[1] Symptoms of illness on presentation, management: (antibiotics, corticosteroids) and history of influenza vaccine was taken. Chest X ray was done for all patients to exclude other chest diseases

Inclusion criteria:

- Patients with persistent asthma aged >2 years to exclude occasional wheezes due to viral respiratory tract infections.

Exclusion criteria:

Patients were excluded if they were:

- Mild intermittent asthma.
- Having other chronic illness as congenital heart disease, cystic fibrosis, etc.

Statistical analysis:

The collected data were coded, tabulated, and statistically analysed using IBM SPSS statistics (statistical package for social sciences) software version 21.0 IBM Corp., Chicago, USA, 2013. Descriptive statistics were done for quantitative data as minimum and maximum of the range as well as mean±SD (standard deviation) for quantitative parametric data, while it was done for qualitative data as number and percentage.

Inferential analyses for independent variables were done using Chi square test for differences between proportions and student t-test for continuous variables, for more than two group ANOVA test was used, Person correlation coefficient was used to find the correlation between each two variables.

The level of significance was taken at P value less than 0.05 is highly statistically significant, otherwise is non-significant.

RESULTS

Comparison between the two studied groups regarding the demographic data demonstrated that there was no statistical significant difference between the two studied groups regarding the demographic data ($p>0.05$) Table 1.

The duration of the disease, in group A ranged from 1-8 years with a mean of 4.65±2.69 while in group B it ranged from 1-3 years with a mean of 2.1±0.36 with a significant statistical difference between the 2 groups ($p=0.001$). The longer the duration of the disease the more need for readmission with acute asthma exacerbations (Table 2).

There was a statistical significant difference between 2 groups as regards asthma triggers; exercise (p=0.02), dust (p=0.032) and respiratory viral infections (p=0.002) to be more common in patients with repeated admissions group (A) compared to other group (Table 2).

Table 1: Comparison between the two studied groups regarding the demographic data.

Demographic data	Group (A)		Group (B)		P
	No.	%	No.	%	
Age (years)					
4-6	18	36.0	15	30.0	0.42
>6-12	17	34.0	19	38.0	0.812
>12-14	15	30.0	16	32.0	
Range	4.5-13.0		4-14		
Mean	9.09		8.65		0.211
S.D.	3.98		4.01		
Sex					
Male	30	60.0	27	54.0	0.37
Female	20	40.0	23	46.0	0.544
Residence					
Urban	36	72.0	32	64.0	0.98
Rural	14	28.0	18	36.0	0.45
Socioeconomic					
High	3	6.0	6	12.0	3.61
High middle	6	12.0	8	16.0	0.306
Low middle	22	44.0	25	50.0	
Low	19	38.0	11	22.0	

P: p value for Chi-square test; *= p≤0.05; significant.

Comparing the two studied groups regarding compliance and adherence to treatment, follow up and disease control (Table 3).

Good compliance to treatment was found in 14% and 36% of the patients in group A and B respectively with a statistical significant difference between the 2 groups (p=0.0001). Readmission rate is decreased in patients with good compliance.

Regular follow up was present in 3 (6%) and 22 (44%) of group A and B respectively. cases with no follow up were 47 (94%) and 28 (36%) in two groups respectively. There was statistical significant difference between the two studied groups regarding follow up (p<0.0001).

For disease control, controlled was zero (0%) and 16 (32%), partially controlled 41 (82%) and 32 (64%), uncontrolled was nine (18%) and two (4%) in two groups respectively. There was statistical significant difference between the two studied groups regarding disease control (p<0.0007).

Comparing the two studied groups regarding school attendance, sleep disturbance and the disease severity (Table 4).

Table 2: Comparison between the two studied asthmatic groups regarding duration of disease and asthma triggers.

Data	Group (A) (read mission group)		Group (B) (first admission)		P
	No.	%	No.	%	
Duration of the disease					
Range	1-8		1-3		
Mean	4.65		2.1		0.001*
S.D.	2.69		0.36		
Asthma triggers					
a. Inhalation					
Pollen	14	28	16	32	0.06
Dust	43	86.0	18	36.0	0.0032*
Odours	9	18	10	20	0.969
b. Physical conditions					
Cold	20	40	22	44	1.55
Fluctuations of air	32	64	24	48	0.670
c. Exercise	47	94.0	12	24.0	0.001*
d. Respiratory viral infection	38	76.0	14	28.0	0.002*
e. Insect bite	5	10	7	14	0.38
f. Food					
Chocolate	11	22	8	16	
Banana	7	14	6	12	0.58;
Fish	10	20	7	14	0.901
Spicy food	4	8	5	10	

P: p value for Chi-square test; *= p≤0.05; significant.

Table 3: Comparison between the two studied groups regarding compliance and adherence to treatment, follow up and disease control.

Compliance and adherence to treatment	Group (A)		Group (B)		P
	No.	%	No.	%	
Good	7	14.0	18	36.0	
Moderate	8	16.0	22	44.0	25.38;
Poor	22	44.0	7	14.0	0.0001*
No	13	26.0	3	6.0	
Follow up					
Yes	3	6.0	22	44.0	18.98;
No	47	94.0	28	56.0	0.0001*
Disease control					
Controlled	0	00.0	16	32.0	16.97;
Partially	41	82.0	32	64.0	0.0007*
Uncontrolled	9	18.0	2	4.0	

P: p value for Chi-square test; *= p≤0.05; significant.

School attendance was affected in 44 (88%) and 12 (2%) in two groups respectively. Sleep disturbance was present in 30 (60%) and 19 (38%) respectively. There was statistical significant difference regarding effect on school attendance and sleep disturbance (p=0.001 and p=0.027 respectively).

Regarding disease severity, severe was 20 (24%) and 12 (24%), moderate 24 (48%) and 22 (44%), mild 6 (12%) and 16 (32%) in the two groups respectively. There was statistical significant difference regarding disease severity (p< 0.036). The more the severe the disease the more the readmission rate to the hospital.

Table 4: Comparison between the two studied groups regarding school attendance, sleep disturbance and the disease severity.

	Group (A)		Group (B)		P value
	No.	%	No.	%	
Effect on school attendance	44	88.0	12	24.0	16.77; 0.001*
Sleep disturbance	30	60.0	19	38.0	0.027*
Disease severity					
Severe	20	40.0	12	24.0	6.63; 0.036*
Moderate	24	48.	22	44.0	
Mild	6	12.0	16	32.0	

P: p value for Chi-square test; *= p≤0.05; significant.

As for the previous PICU admission, it was detected in 3 (6%) in group (A) while no patients were previously admitted to PICU in group (B) 0 (0%). No statistical significant difference between two studied groups (p=0.107) was found.

No significant difference was found between 2 groups as regards housing conditions (family size, separate room, separate bed, presence of animal at home, ventilation and smoking at home.

Neither the presence of associated allergic diseases nor the family history of allergic disease showed a significant statistical difference between the 2 groups.

As regards influenza vaccination: in this study there was no history of influenza vaccination in all patients in the two studied groups. So the effect of vaccination on acute asthma exacerbation readmission could not be assessed.

DISCUSSION

The definition of 'readmission' varies among different studies. Readmission was defined in this study as the one which occurred within one month to one year after the patient first admission. The incidence of readmission for asthma varies from country to country. The incidence varies from 15% in France and Rhode Island (USA) to 40 % in Oulu (Finland).[10-12]

The objective of this study was to identify the risk factors for readmission because of acute asthmatic exacerbations. If these risk factors could be abolished, there would be possible savings for health services, familial spending's together with improvement in the quality of life of the entire family.

The mean age of patients in group A and B was 9.09±3.98 and 8.65±4.01 respectively. 60% of patients in the group A were males and 40% were females while 54% and 46% of patients in group B were males and females respectively without age nor sex differentiation effect on readmission between the two studied groups. Similar finding was present in the study done by Akrishman et al and Gwynn et al, they reported the prevalence of asthma to be greater in male patients aged less than 15 years with no sex related differences in acute asthma exacerbation readmission rate.[13,14] It may be just a mirroring of overall age-related disease prevalence, the group of those who were severe enough to be hospitalized does not differ between male and female patients. The possible reason that we found in this study more boys than girls was that the age of the patients included was up to 14 years only. Boys in this age group suffer from asthma more than girls may be because early onset asthma could be explained by male-female difference in ways of lung growth and maturity; increase susceptibility to infection in boys and difference in environmental risk factors exposure.

As regards socioeconomic status it was found that most of the patients in group A and B respectively of low middle socioeconomic class but without statistical significant differences between the two studied group (p>0.05). The role of socioeconomic factors in the attribution of asthma is complicated. The hygiene hypothesis presume that higher levels of hygiene have reduced the possibility for cross-infection in childhood and increased the chance of atopic sensitization.[15] Although rich and poor children living in urban areas may be less exposed to faeco-oral pathogens equally than in the past, yet poorer children may still be more vulnerable to many risk factors promoting acute asthma exacerbations attacks and readmission. These risk factors may enclose: airborne viruses, smoke, pollens, cockroaches, indoor dampness and difficult access to healthcare units.[16-18]

Our study in agreement with Duran-Tauleria et al who found that patients from low socioeconomic backgrounds are more prone to have an increased prevalence of severe asthma symptoms, even if the overall prevalence is not different from the rest of the population.[19]

In our study we used family size, presence of separate bed and separate room as indicators for crowding index according to American crowding index.[20] James et al suggested that poor housing conditions as crowding, and inadequate ventilation are associated with a wide range of health conditions, including severe asthma symptoms,

frequent exacerbations and respiratory infections.[21] We did not find any association between family housing conditions nor house holding smoking and readmission, (p>0.05). Deep thinking about household crowding had centred on its possible role as a risk factor for transmissions of viral infections, especially those transmitted by droplet infection which is considered to be triggers of asthma thus increasing the exacerbation rate and hospitalization.

In this study associated allergic diseases (allergic rhinitis, conjunctivitis, skin and food allergy) were not found to be another risk factors for acute asthma exacerbation readmission (p>0.05). Contrary, De Groot et al reported that allergic rhinitis has a major impact on asthma control and frequent exacerbations.[22] Van Cauwenberge et al, Corren et a1 and Passalacqua et a1 also reported that there is an association between asthma control and atopic disease and documented that proper treatment of atopic disease may improve asthma control.[23-25] The difference with studies possibly because the sample size in the readmission group is too small.

In the present study it was found that mean value for the duration of the disease was 4.65±2.69 and 2.1±0.36 in group A and B respectively with a detected statistical significant difference (p=0.001). So longer duration of the disease was a risk factor for acute exacerbations readmissions. This is in agreement with Tony et al who reported that longer durations is associated with more severe asthma and frequent exacerbations due to greater alterations of the airways occurring with longer duration.[26] The same was detected by Bai et al who reported that longer duration is associated with more severe asthma and frequent exacerbations due to the airways of older should show greater alterations than the airways of younger.[27] In contrary with De Blic et al who reported that poorer asthma control was associated with more recent diagnosis of asthma.[28]

It was found that viral infection is a risk factor for acute asthma exacerbation readmission, viral infections was detected in 38 (76%) and 14 (28%) cases in group A and B respectively, with a significant difference between both studied groups (p=0.002). This is in agreement with khtsuriani et al and Busse et al, studies which reported that it is an important contributor to asthma exacerbation in children.[29,30]

Regarding asthma triggers the study showed a significant statistical difference between two studied groups regarding dust as a risk factor for acute asthma exacerbation readmission, this is in agreement with the institute of medicine in Washington and Ruth et al that have concluded that sensitization to dust is an important risk factor for asthma exacerbations and rehospitalization.[31,32]

As for disease severity, severe was 20 (24%) and 12 (24%), moderate 24 (48%) and 22 (44%), mild 6 (12%) and 16 (32%) in the two groups respectively. There was statistical significant difference regarding disease severity (p<0.05). In agreement with the previous result is the findings of Alaa et al who documented that higher percentage of hospitalization were among cases with severe and moderate bronchial asthma compared to mild cases.[33]

In this study There is a significant statistical differences as regards compliance and adherence to treatment (p=0.0001), presence of follow up (p=0.0001) and disease control (p=0.0007) between the 2 groups. As readmission rate increased with bad compliance, lack of regular follow up, and poor asthma control. This was comparable with other studies which found that asthma control depends on disease severity because severity is closely related to treatment response (i.e. degree of control).[34,35] It was reported that severely asthmatic patient still had poorly controlled asthma with frequent exacerbations and readmissions despite use of high dose (inhaled corticosteroids) ICS. This difference was depending on their adherence to the prescribed treatment (compliant or non-compliant).

It was found that there was follow up in 3 (6%) and 22 (44%) cases in group A and B respectively and no follow up were 47 (94%) and 28 (56%) cases in two groups respectively. There was a statistical significant difference between the two studied groups (p=0.0001). The causes of lack of follow up in this study were mainly: low socioeconomic status (major cause), wrong parental beliefs and attitudes (if the controller medication should be used daily, worries about the side effects of the drugs and lack of interest of the parents). These findings are in agreement with the results of Jentzsch et a1 and Laforest who reported that poor compliance and follow up were the probable mechanism for poor asthma control and the cause of increase hospitalization and good adherence to prescribed medication is needed for better asthma control.[36,37] Many other studies described that there is a relationship between poor control and low socio-economic status.[38,39]

The previous ICU admission in group A and B it was 3 (6%) and 0 (0%) respectively. there was no statistical significant differences between two studied groups. This surprising result may be because of the small sample size.

CONCLUSION

Duration of the disease, viral infections, common cold, dust and exercise are risk factors for acute asthma readmission. Severity of the disease and adherence to medications affect acute asthma readmission.

Recommendations

- In medical records we have to differentiate between first admission and re-admission, thus we are able to determine whether the apparent increase in hospital

admissions is due to increase in the number of readmissions or an increase in the prevalence of asthma.

- Assessment of asthma severity must be done in first visits and follow up visit and choice suitable protocol for treatment. Written action plan should put in as an essential component of asthma management to improve the clinical status of patients, reduce the severity of symptoms, and mortality of asthma attacks.

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