# Original Article

# Predisposing factors and clinical profile of acute severe asthma

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## ABSTRACT

**Background:** Asthma is a chronic inflammatory condition of the lung airways resulting in episodic airflow obstruction. It is also one of the leading causes of morbidity in children and hospital admissions. Current treatments, although helpful, are still unable to prevent childhood asthma exacerbations completely. **Objectives:** To study the clinical profile and predisposing factors for acute severe asthma in children. **Methods:** This prospective study was conducted between January 2015 and December 2015 in a tertiary care teaching hospital. Children between the age group of 5 and 18 years admitted with symptoms and signs of acute severe asthma formed the study group. Detailed history and examination were recorded in a systematically designed pro forma, and these patients were evaluated for the predisposing factors. **Results:** Out of 100 children with acute severe asthma, the predominant age group was between 5 and 10 years (68%). Boys are more commonly affected than girls in the ratio of 1:1.2. The most common predisposing factors were family history of asthma (60%), atopy (32%), and dermatitis (23%). The common risk factors responsible for acute exacerbations were viral infections (83%), poor drug compliance (68%), and exposure to house dust (61%). 55% of the children had acute exacerbation during the winter season. The common comorbid conditions were rhinosinusitis (35%), obesity (23%), and gastroesophageal reflux (9%). Eosinophilia was seen in 62% of the children with acute severe asthma. **Conclusion:** In the present study, majority of the asthmatics were males and belonged to urban area. Viral infections were the predominant factor for exacerbations and others like family, and previous history of atopy/allergic rhinitis/dermatitis, food allergy, indoor and outdoor pollution, seasonal variations, and comorbid conditions like obesity and rhinosinusitis were the common predisposing risk factors.

**Key words:** *Acute severe asthma, Children, Chronic respiratory diseases*

Asthma is one of the common chronic respiratory diseases in childhood, with increasing prevalence in the past 3 decades. The severity of asthma can range from mild to severe; however, despite the degree of severity, all patients are at risk for developing an acute severe asthma exacerbation. Currently, severe acute asthma is the most common medical emergency in children and is responsible for nearly half a million admissions to pediatric intensive care units (PICUs) [1]. Current treatments, although helpful, are still unable to prevent childhood asthma exacerbations completely.

There is a scarcity of data regarding the incidence of acute asthma exacerbation in children in India. In the United States, as per 2005 National Center for Health Statistics estimates, asthma prevalence was 22.5 million (7.7% of population) and exacerbations included approximately 15 million outpatient visits, 2 million emergency room visits, and 500,000 hospitalizations over 1 year [2]. In urban areas, asthma prevalence is increasing due to increase in environmental smoke and air pollution resulting from urbanization and industrialization. A study conducted in Bangalore city among <18 years of age showed that asthma prevalence increased to quite a great extent from 1979 (9%) to 1999 (29.5%) [3]. As there are limited studies in our country regarding acute severe asthma and its predisposing factors contributing for exacerbation, the present study was undertaken to know the predisposing factors and clinical profile of acute severe asthma in children.

## MATERIALS AND METHODS

This prospective hospital-based study was carried out for 12 months between January 2015 and December 2015 in a teaching institution of South India. Prior approval from the institutional ethics committee was obtained and written consent/assent was taken from the parents of the recruited children. Children between 5 and 18 years of age admitted to PICU of our hospital with symptoms and signs of acute severe asthma (as per Becker's score) were included in the study (Table 1). Children <5 years of age, whose symptoms were considered to be of infective origin, who were immunosuppressed and whose parents were unwilling to participate in the study were excluded. Sample size was taken by convenience.

**Table 1: Clinical classification of acute severe asthma as per Becker's scoring [4]**

| Score | Respiratory rate | Wheezing | I:E ratio | Accessory muscle use |
|-------|------------------|----------|-----------|----------------------|
| 0 | <30 | None | 1:1.5 | None |
| 1 | 30-40 | Terminal expiration | 1:2 | 1 site |
| 2 | 41-50 | Entire expiration | 1:3 | 2 sites |
| 3 | >50 | Inspiration and entire Expiration | >1:3 | 3 sites or neck strap muscles |

Score: Mild - 1-3, moderate - 4-7, severe - >7

A detailed history was obtained from their parents/caretakers and documented in a systematically designed proforma. Details of demographic profile included age, sex, and weight of the children, residence, education of the mother and father, and socioeconomic status (according to modified Kuppuswamy classification). The history included history of cough, wheezing, breathlessness, diurnal and seasonal variations of symptoms, precipitating/triggering factors, history of similar episodes, family history of asthma, atopy, allergic rhinitis, and treatment history.

Thorough general and systemic examination was also performed and following investigations were done: Complete blood count, absolute eosinophil count (AEC), arterial blood gas, chest X-ray, and serum electrolytes, as and when indicated. Then, we tried to correlate the severity of their asthma symptoms and clinical presentation with these investigations. An AEC value of $\geq$440/$\mu$L was considered as significant.

All data were analyzed using SPSS software version 18.0 with 95% confidence interval. Continuous variables were expressed in terms of mean $\pm$ standard deviation. Categorical variables were expressed in terms of frequencies and percentages. Associations were calculated between relevant parameters using Chi-square test. $p<0.05$ was considered significant.

## RESULTS

A total of 100 children were admitted with signs and symptoms of acute severe asthma during the study period and were analyzed. In our study, majority of the children were in the age group of 5–10 years (68%), followed by 11–15 years age group (32%), and least in 15–18 years age group. Male (55%) predominated over female (45%) in the ratio 1:1.2. Majority of the children (52%) were from the urban region and 48 cases were rural areas. Total 62 children belonged to low socioeconomic status while 32 and 6 cases were from middle and high socioeconomic status.

Majority of the children had family history of asthma which contributes to 60%, followed by atopy in 32%, and dermatitis in 23% cases (Table 2). In our study, main triggering factor for acute severe asthma was viral infections which contribute to 83% of the cases.

The house dust 61% was the most important predisposing factor, followed by indoor pollution (42%), and cockroaches (38%). Acute asthma was seen in 16% of the children with exposure to pollen and environmental dust, each. The majority of children (55%) had acute asthma during winter season while rest 45% children had acute asthma episodes in the rainy season. The major comorbid condition was rhinosinusitis (in 35%

**Table 2: Family and past history of the cases**

| Family history | Present | Absent | p value |
|----------------|---------|--------|---------|
| Asthma | 60 | 40 | <0.002 |
| Atopy | 32 | 68 | |
| Dermatitis | 23 | 77 | |
| Poor drug compliance | 68 | 32 | <0.0001 |
| Viral infections | 83 | 17 | |

**Table 3: Distribution of subjects according to predisposing factors and comorbidities**

| Conditions | Present | Absent | p value |
|------------|---------|--------|---------|
| Indoor exposures | | | |
| Indoor pollution | 42 | 58 | |
| House dust | 61 | 39 | |
| Cockroaches | 38 | 62 | <0.0001 |
| Molds | 32 | 68 | |
| Animal dander | 27 | 73 | |
| Deodorant and perfumes | 11 | 89 | |
| Outdoor exposures | | | |
| Pollen | 16 | 84 | >0.05 |
| Environmental dust | 16 | 84 | >0.05 |
| Comorbid conditions | | | |
| Rhinosinusitis | 35 | 65 | <0.001 |
| Obesity | 23 | 77 | |
| Gastroesophageal reflux | 9 | 81 | |

cases), followed by obesity in 23 cases, and gastroesophageal reflux in 9 cases (Table 3). Total 62% of the children had raised AECs.

## DISCUSSION

Asthma is a chronic inflammatory condition of lung airways resulting in episodic airflow obstruction characterized by acute onset of episodes of wheezing, breathlessness, and coughing, particularly at night or in the early morning. These symptoms are usually associated with widespread but variable bronchoconstriction and airflow limitation that is partly reversible, either spontaneously or with treatment [5]. It is thought that inflammation causes an increase in airway responsiveness (bronchospasm) to a variety of stimuli. Some children may be hypersensitive to common air pollutants (environmental tobacco smoke, ozone, and endotoxin) such that exposures to these pollutants might not only make existing asthma worse but may also have a causal role in the susceptible.

Although the exact pathophysiology of asthma remains unknown, it is caused by a combination of complex and incompletely understood environmental and genetic interactions. These factors influence both its severity and its responsiveness to treatment. A number of other health conditions occur more frequently in those with asthma, including gastroesophageal reflux disease (GERD), rhinosinusitis, obesity, and obstructive sleep apnea. Psychological stress and physical exercise also trigger asthma. It is believed that the recent increased rates of asthma are due to changing epigenetics and a changing living environment [6].

In our study, the most common age group of children with acute asthma were between the age group of 5 and 15 years and male children were more commonly affected than female children. This was also reported by other previous studies [6-8]. This could be due to the fact that children belonging to this age group are probably more exposed to environmental pollution. The present study showed more prevalence of severe asthma in urban areas than the rural areas, which are comparable to the study by Chakravarthy *et al.* [9] and Elnady *et al.* [10]. The reason could be awareness in urban areas to seek health care and also, urban children are probably more exposed to environmental pollution. The present study showed more prevalence of severe asthma with low socioeconomic status as shown in other studies [11-14].

In the present study, family history of asthma constituted about 60% cases followed by atopy in 32% and dermatitis in 23% cases. Most cases in our study had significant family history of allergic conditions which show that severe asthma may have familial inheritance and it is an important predisposing factor. Similar observations were made by other authors also. In our study, rhinosinusitis (35%) was a common comorbid condition followed by obesity (21%) and GERD (9%). These results were comparable to the results of the studies conducted by Turner and Kemp [15] and Lang [16].

In our study, exposure to house dust (61%) and cockroaches (38%) were common followed by animal dander and molds. In a study conducted by Stephen *et al.*, the house dust mite and cockroach antigen were found to be the risk factors for triggering acute severe asthma [17]. Viral infection constitutes 83% of the cases in our study compared to a study by Kwon *et al.* [18], where 64.3% of the cases with asthma exacerbations showed prior viral infections. Poor drug compliance (68%) was also a significant risk factor for the acute exacerbations of asthma as shown by Mitchell *et al.* [19]. In our study, more cases were seen during winter (54%) and rainy season (44%) as seen in a study by Won *et al.* [20]. In cold air, the airways become hyperresponsive and also, during cold climatic conditions, viral infections are more common.

Limitation of our study was that the study population is too small to conclude and the results cannot be generalized. We could not do skin prick tests or specific serum immunoglobulin levels due to logistic reasons and financial constraints. Asthma education of the children, parents, and caretakers regarding avoidance of the triggering factors, importance of drug compliance, and addressing the comorbid conditions may go a long way in prevention of acute severe asthma, and to avoid the visit to emergency care.

## CONCLUSION

Aeroallergens and viral infections were the common triggering factor for the acute severe asthma. Viral infections and poor drug compliance were the significant risk factors for PICU admission in children with ASA. The present study has shown that majority of the asthma cases were males and belonged to urban area.

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