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Original Research Article

CLINICO- EPIDEMIOLOGICAL PROFILE OF ACUTE SEVERE ASTHMA IN CHILDREN PRESENTING TO THE EMERGENCY ROOM: A PROSPECTIVE STUDY

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ABSTRACT

Background: Acute severe asthma is a major cause of pediatric emergency admissions and contributes significantly to childhood morbidity. Environmental triggers, atopy, and familial predisposition play important roles in disease exacerbation. The aim is to study the clinical and epidemiological profile of children presenting with acute severe asthma in the emergency room and to evaluate factors associated with disease severity and treatment outcomes.

Materials and Methods: This prospective observational study was conducted in the pediatric emergency room and PICU of a tertiary care teaching hospital over a period of 12 months. A total of 106 children aged 1- 12 years with acute severe asthma were included. Detailed demographic, clinical, epidemiological, and treatment-related data were recorded. Severity was assessed using the Pulmonary Score Index (PSI). All children received standard treatment including oxygen, nebulized salbutamol, ipratropium bromide, and corticosteroids.

Results: The majority of children belonged to the 2–5 years age group (66.9%) with slight male predominance (53.8%). Urban background was noted in 58.5% of children. Atopy was present in 88.7% of cases, with allergic rhinitis being the most common associated atopic condition. Allergens (89.9%), physical exercise (80.1%), viral respiratory infections (57.5%), and passive smoking (56%) were the major precipitating factors. All children presented with severe asthma (PSI >6) at admission. Significant clinical improvement was observed following standard treatment, and all children improved to mild PSI status within 24 hours. Most children (98.1%) were discharged within 72 hours.

Conclusion: Acute severe asthma in children was strongly associated with atopy, environmental triggers, and family history. Early recognition and prompt standard emergency management resulted in favourable clinical outcomes and shorter hospital stay.

Keywords: Acute severe asthma, Allergens, Atopy

INTRODUCTION

Asthma is one of the most common chronic respiratory disorders affecting children worldwide and remains a major cause of emergency room visits, hospitalization, school absenteeism, and healthcare burden. Acute severe asthma is characterized by rapidly progressive airway obstruction resulting from bronchial hyperresponsiveness, mucosal edema, and excessive mucus secretion, leading to respiratory distress and hypoxemia if not promptly treated. The prevalence of childhood asthma has increased significantly over recent decades, particularly in developing countries due to urbanization, environmental pollution, allergen exposure, and changing lifestyle patterns.[1]

Acute severe asthma in children presents with varying clinical manifestations including tachypnoea, wheezing, chest tightness, use of accessory respiratory muscles, and reduced oxygen saturation. Several precipitating factors such as viral respiratory tract infections, allergen exposure,

seasonal variations, smoke exposure, and poor adherence to maintenance therapy contribute to exacerbations. Epidemiological studies have shown that socioeconomic status, family history of atopy, environmental tobacco smoke, and indoor air pollution significantly influence the occurrence and severity of asthma attacks in children. Early identification of these risk factors can aid in preventive strategies and improve disease outcomes.[2]

Despite advancements in treatment protocols, acute severe asthma continues to account for a substantial proportion of pediatric emergency admissions. The Global Initiative for Asthma (GINA) emphasizes prompt assessment of severity and initiation of evidence- based therapy including oxygen supplementation, inhaled bronchodilators, corticosteroids, and close monitoring.[3]

In India, childhood asthma poses a significant public health concern with increasing incidence reported from both urban and rural populations. This study aims to evaluate the clinico-epidemiological profile of acute severe asthma in children presenting to the emergency room and to identify factors associated with disease severity and treatment outcomes.[4,5]

Aim: To study the clinical and epidemiological profile of children presenting with acute severe asthma in the emergency room and to evaluate factors associated with disease severity and treatment outcomes.

Objectives:

1. To describe the clinical profile, assess severity using pulmonary index score and evaluate the epidemiological factors associated with acute severe asthma in children.
2. To determine the association between epidemiological factors and severity of asthma and
3. To study the treatment response and clinical outcomes.

MATERIALS AND METHODS

Study area: Department of Pediatrics, Emergency Room and Pediatric Intensive Care Unit (PICU) of a tertiary care teaching hospital.

Study design: Prospective study

Study period: 12 months

Study population: Children presenting with acute severe asthma to the pediatric emergency room.

Inclusion criteria

Children aged 1- 12 years presenting to the emergency room with clinical features of acute severe asthma as per GINA guidelines, including breathlessness, wheezing, cough, respiratory distress, and requiring emergency management.

Exclusion criteria

Children with respiratory distress due to causes other than asthma such as bronchiolitis, pneumonia, pleural effusion, empyema, congenital heart disease, foreign body aspiration, pulmonary tuberculosis, metabolic acidosis, and children with known chronic pulmonary disorders other than asthma.

Sample size: Considering the prevalence of acute severe asthma as 7%, using absolute precision and 5% standard error a sample size of 106 patients was included.

Study tools: Diagnostic Nasal Endoscopy (DNE) using 0° and 30° rigid nasal endoscopes and Computed Tomography (CT) scan of the paranasal sinuses.

Methodology: After obtaining informed written consent from parents or guardians, detailed demographic data, epidemiological factors, and clinical history were recorded for all participants. Information regarding age, gender, socioeconomic status, family history of asthma or atopy, exposure to tobacco smoke, seasonal variation, allergen exposure, previous asthma episodes, hospitalization history, and treatment history was collected. A thorough clinical examination was performed at presentation, including assessment of respiratory rate, oxygen saturation, wheeze, accessory muscle usage, pulse rate, and level of respiratory distress. Severity of asthma was assessed using the Pulmonary Index Score. All patients received standard treatment for acute severe asthma according to institutional protocol. Patients were monitored for treatment response, duration of hospital stay, requirement for PICU admission, need for ventilatory support, and final outcome. Categorical variables were expressed as frequencies and percentages.

RESULTS

[Table 1] shows the sociodemographic distribution of children presenting with acute severe asthma. The majority of children belonged to the 2- 5 years age group, accounting for 66.9% of the study population, followed by 29.3% in the 6- 9 years age group, while only 3.8% were aged between 10- 12 years. Male children constituted 53.8% of the study population, whereas females accounted for 46.2%, showing a slight male predominance. Regarding socioeconomic status, most children belonged to the upper middle class (31.1%), followed by middle class (24.6%) and lower class (21.7%). Children from upper class families constituted 19.8% of the study population, while only 2.8% belonged to the lower middle class and 58.5% belonged from an urban background and 41.5% were from rural background. A positive family history among other relatives such as uncles, aunts, and cousins was the most common finding, observed in 43 (40.5%) children. Maternal history was present in 29 (27.4%) cases, while paternal history was noted in 16 (15.1%) children. History among grandparents was seen in 12 (11.3%) cases, whereas sibling history was the least common, observed in 8 (7.5%) children. Among the 106 children included in the study, 94 (88.7%) had a positive history of atopy, whereas only 12 (11.3%) had no history of atopy.

[Figure 1] depicts the distribution of different types of atopies among children with acute severe asthma. Allergic rhinitis was the most common type of atopy observed, accounting for 40% of cases, followed by atopic dermatitis in 35% of children. Allergic conjunctivitis constituted 18% of cases, while other forms of atopy accounted for 7%.

[Table 2] shows the distribution of precipitating factors among children presenting with acute severe asthma. Allergens were the most common precipitating factor, identified in 95 (89.9%) children, followed by physical exercise in 85 (80.1%) cases. Viral respiratory infections were observed in 61 (57.5%) children, while passive smoking was reported in 52 (56%) cases. Air pollutants accounted for 17 (16%) cases. Only one child (0.9%) had exposure to challah as a precipitating factor. The common allergens were house dust, cockroaches, smoke, ash, weeds and animal dander.

In [Table 3] all children presented to the emergency room with severe acute asthma having a Pulmonary Score Index (PSI) greater than 6. Following administration of rescue steroids and standard treatment, gradual clinical improvement was observed. After 6 hours of treatment, 68.8% of children improved to mild asthma status, while 9.4% improved to moderate severity. By 12 hours, none of the children remained in the severe category, and the majority had mild symptoms. At the end of 24 hours, all children showed significant recovery with PSI scores in the mild range (0- 3). These findings indicate good treatment response to standard emergency management of acute severe asthma.

[Table 4] shows the distribution of treatment modalities administered to children presenting with acute severe asthma. All children (100%) received corticosteroid therapy, oxygen supplementation, and salbutamol nebulization as part of standard emergency management. Intravenous fluids were administered to 30 (30%) children, mainly in those requiring supportive care due to poor oral intake, dehydration, or severe respiratory distress. Antibiotic therapy was given to 17 (16.03%) children, likely in cases with suspected associated respiratory infection. Other medications such as mucolytics and cough syrups were used in only 5 (4.7%) children.

[Table 5] shows the duration and frequency of Short-Acting Beta Agonist (SABA) therapy required among children with acute severe asthma. All 106 children (100%) received the initial emergency treatment consisting of three doses of SABA administered 20 minutes apart. Following the initial management, 83 (78%) children required hourly SABA administration during the first three hours. Subsequently, 73 (68%) children continued to require SABA every two hours over the next six hours. Fifty (47%) children required four-hourly bronchodilator therapy during the following 16 hours, whereas only 20 (18%) children continued to require six-hourly SABA administration over the next 24 hours.

[Table 6] shows majority of children, 74 (69.8%), required six doses of ipratropium bromide alternating with SABA therapy, while 24 (22.64%) children required five doses and 8 (7.5%) required only three doses. Regarding rescue therapy, aminophylline infusion was required in 12 (11.35%) children, whereas subcutaneous adrenaline was administered in 5 (4.7%) children. With respect to hospital stay, the vast majority of children, 104 (98.1%), recovered and were discharged within 72 hours, while only 2 (1.9%) children required hospitalization for more than 72 hours.

Table 1: Sociodemographic distribution

Socio- demography	Frequency	Percent
Age		
2- 5 years	71	66.9%
6- 9 years	31	29.3%
10- 12 years	4	3.8%
Gender		
Males	57	53.8%
Females	49	46.2%
Socio- economic class		
Upper class	21	19.8%
Upper middle class	33	31.1%
Middle class	26	24.6%
Lower middle class	3	2.8%
Lower class	23	21.7%
Residential background		
Urban background	62	58.5%
Rural background	44	41.5%
Family history		
Father	16	15.1%
Mother	29	27.4%
Siblings	8	7.5%
Grandparents	12	11.3%
Others (uncles, aunts, cousins)	43	40.5%
Atopy		
Present	94	88.7%
Absent	12	11.3%
Total	106	100%

Table 2: Distribution of precipitating factors

Precipitating factors	Frequency	Percent
Allergens	95	89.9%
Physical exercise	85	80.1%
Viral respiratory disease	61	57.5%
Passive smoking	52	56%
Air pollutants	17	16%
Challah	1	0.9%

Table 3: Pulmonary score index (PSI) findings

PSI	At the end of 1 hr	After 6 hrs	After 12 hrs	After 24 hrs
0- 3 (mild)	-	73 (68.8%)	83 (78.3%)	106
3- 6 (moderate)	-	10 (9.4%)	23 (21.6%)	-
>6 (severe)	106	23 (21.6%)	-	-

Table 4: Therapeutic distribution among the subjects

Treatment given	Frequency	Percent
Cortico- therapy	106	100%
Oxygen	106	100%
Salbutamol	106	100%
I. V fluids	30	30%
Antibiotic treatment	17	16.03.
Others (mucolytics and cough syrups)	5	4.7%

Table 5: Duration for which short acting beta agonists (SABA) were required

Duration	Frequency	Percent	No. of doses
3 doses 20 min apart	106	100%	3
Hourly for the first three hours	83	78%	6
2nd hourly for the next 6 hours	73	68%	9
4th hourly for the next 16 hours	50	47%	13
6th hourly for the next 24 hours	20	18%	19

Table 6: Distribution of Ipratropium bromide, rescue steroid requirement and hospital stay

No. of doses of ipratropium	Frequency	Percent
6 doses alternating with SABA 6th hourly	74	69.8%
5 doses alternating with SABA 6th hourly	24	22.64%
3 doses alternating with SABA 6th hourly	8	7.5%
Rescue steroid		
Aminophylline drip	12	11.35
Subcutaneous adrenaline	5	4.7%
Duration of hospital stay		
<72 hours	104	98.1%
>72 hours	2	1.9%

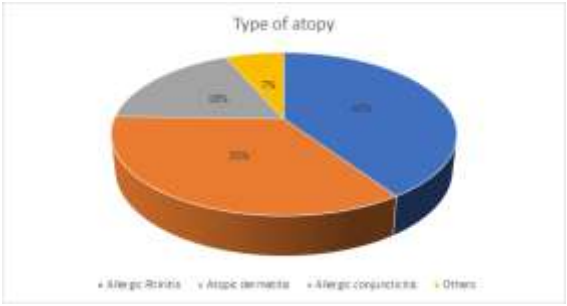

Figure 1: Pie chart showing type of atopy

DISCUSSION

In the present study, the majority of children with acute severe asthma belonged to the 2–5 years age group (66.9%), with a slight male predominance (53.8%). Similar observations were reported by Babu TA et al,[5] who found higher prevalence of severe asthma among younger children and males and increased airway hyperreactivity in early childhood. Mallol J et al,[6] also reported increased asthma prevalence among preschool children in urban populations.

A higher proportion of children in the present study were from urban areas (58.5%). Urban predominance has been consistently observed in previous studies due to increased exposure to vehicular pollution, indoor allergens, overcrowding, and environmental tobacco smoke. Gupta D et al,[7] reported significantly higher asthma prevalence among urban Indian children compared to rural populations.

Atopy was highly prevalent in the current study, with 88.7% of children demonstrating positive atopic history. Allergic rhinitis was the most common associated atopic condition. These findings are comparable with the ISAAC study,[8] which established a strong association between asthma and other atopic disorders such as allergic rhinitis and atopic dermatitis.

The strong familial predisposition observed in our study also correlates with Ober C et al,[9] highlighting genetic susceptibility as an important risk factor for childhood asthma.

Among precipitating factors, allergens (89.9%) were the most common triggers, followed by physical exercise, viral respiratory infections, and passive smoking. Similar findings were reported by Johnston SL et al,[0] who identified viral respiratory infections and allergen exposure as major precipitating factors for acute asthma exacerbations in children.

Environmental tobacco smoke exposure has also been widely recognized as an important contributor to asthma severity and recurrent exacerbations as even reported by Burke H et al.[11]

All children in the present study had severe asthma at admission with Pulmonary Score Index (PSI) >6. Following standard treatment, most children improved significantly within 24 hours. Similar rapid improvement with aggressive bronchodilator therapy and systemic corticosteroids has been documented in pediatric emergency-based studies by Schuh S et al,[12] and Becker AB et al.[13] The progressive reduction in SABA requirement observed in our study reflects effective bronchodilator response and clinical stabilization.

Only a minority of children required rescue therapies such as aminophylline infusion and subcutaneous adrenaline, while 98.1% were discharged within 72 hours. Comparable favourable outcomes and shorter hospital stay have been reported by Keogh KA et al. 14 utilizing standardized asthma management protocols in pediatric emergency settings.

CONCLUSION

Acute severe asthma was more commonly observed among younger children with a strong association with atopy, family history, and environmental triggers such as allergens and passive smoking. Most children showed significant clinical improvement with timely standard emergency management using bronchodilators, corticosteroids, and oxygen therapy. Early identification of precipitating factors and prompt treatment resulted in favourable outcomes and shorter hospital stay in the majority of patients.

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