

# Study on Peripheral Eosinophilia among Paediatric Patients in a Tertiary Care Hospital

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## ABSTRACT

**Introduction:** Eosinophilia may be due to primary or secondary causes. They are divided based on absolute eosinophil count as: mild (less than 1500 cells per cubic millimeter); moderate (1500 to 5000 cells per cubic millimeter); and severe (more than 5000 cells per cubic millimeter). In the paediatric population the prevalence of Hypereosinophilia (HE) is still unknown, because there is no completed population base studies recorded. Evaluating the underlying pathology is an essential step in the management of Paediatric HE. On the basis of the underlying aetiological factors, clinical manifestations may vary from benign, self-resolving eosinophilia to life-threatening disorders with the significant end-organ damage. There is an increase in incidence rates of paediatric eosinophilic esophagitis, gastritis and colitis among the hypereosinophilic patients.

**Aim:** To correlate eosinophilia in different age groups and various diseases among the paediatric patients attending the tertiary care hospital for various illnesses.

**Materials and Methods:** It was a retrospective study conducted for a period of five months, among the paediatric patients who attended the tertiary care centre for various reasons. Complete blood count was done for these patients with the automated haematology analyser. The eosinophil count was assessed by peripheral smear study.

**Results:** Among the total 1341 cases, moderate eosinophilia was observed in 29 patients (17%), severe eosinophilia in 2 patients (1%) and mild eosinophilia in 138 patients (82%). Asthma and Urinary Tract Infection (UTI) (one case each) constituted the two cases of severe eosinophilia. The most common cause of moderate eosinophilia was observed in patients with other causes like iron deficiency anemia and infected wound. The most common cause of mild eosinophilia was due to diseases involving Gastrointestinal system (31 cases).

**Conclusion:** In the present study majority of the cases were found to have mild eosinophilia with a male preponderance.

**Keywords:** Absolute eosinophil count, Allergy, Bacterial infection, Complete blood count, Fever

## INTRODUCTION

Eosinophils develop in the bone marrow in response to IL-5 (interleukin-5), IL-3, Granulocyte-Macrophage Colony-Stimulating Factor (GM-CSF), and IL-33 [1]. IL-5 (interleukin-5) mediates the release of eosinophils from the blood into tissues. Under pathological conditions, it can infiltrate other tissues as well and play an important role in defensive and inflammatory function against the parasites, bacteria, viral infection, neoplasm, allergy [2]. Eosinophilia refers to a condition where there is increased eosinophil count of more than  $0.5 \times 10^9$  /litre [3]. It may be due to primary or secondary causes. Primary causes include clonal and idiopathic causes. Secondary causes include allergy, inflammation, gastroenteritis, respiratory infections, UTI etc., [3-5]. It can also be classified based on Absolute Eosinophil Count (AEC) as Mild (above normal to 1500 cells/microliter) Moderate (1500 to 5000 cells/microliter) Severe (above 5000 cells/microliter) [6-8]. Mild variant was more commonly seen in paediatric cases and in adult patients HE was more prevalent [3,7,8]. HE is defined as the condition where the count is greater than or equal to 1500 cells/microliter obtained on at least two separate occasions (interval of 1 month) or marked tissue eosinophilia. The diagnosis and follow-up of the persistent HE is very important to identify the cause, early management and to prevent end organ damage in paediatric patients.

Majority of the studies showed the prevalence of eosinophilia in adults [9]. As there is a paucity of data on HE in children. Studying the underlying pathology is an essential step in the management of paediatric HE, in order to consider an appropriate treatment strategy. In this study the differential diagnosis for HE in children, was evaluated focusing on aetiologies. The present study aimed to correlate the eosinophilia in different age groups and various diseases, among the paediatric patients, attending the tertiary care

hospital for various illnesses. The data are presented as number and percentage.

## MATERIALS AND METHODS

It was a retrospective study conducted in a Saveetha Medical College and Hospital, a tertiary care hospital in Tamil Nadu, India. The study got approval from the ethical committee with approval number SMC/IEC/2018/11/428. The study was conducted among the paediatric patients admitted in the ward for various illnesses, from May 2018 to October 2018. A total of 1341 paediatric inpatient have been reported in the five month time period. As per the hospital protocol, complete blood count was analysed in a fully automated haematology analyser, sysmex-XN1000 model in the haematology laboratory and the eosinophilia cases were included in the study and the relevant clinical details were collected from the medical records. Eosinophilia was categorised based on AEC [6-8].

## RESULTS

Of the 1341 paediatric patients admitted for various illnesses, 169 (12.6%) were found to have eosinophilia. The occurrence was more in the 10 to 12 years age group (30%) followed by 7 to 9 years group (24%) and male gender was more prone. Majority of eosinophilia paediatrics patients were from Thiruvallur followed by Kancheepuram [Table/Fig-1].

Mild eosinophilia was found to be more common (82%) in paediatric patients which was followed by moderate eosinophilia (17%). Severe eosinophilia had only (1%) occurrence in our study in the given period of time and the causes were asthma and UTI. Common causes of moderate eosinophilia were pyrexia of unknown origin, respiratory tract infection, asthma, gastroenteritis [Table/Fig-2,3].

Age	No. of cases	Male	Female	Demography (on the basis of occurrence)
6 months to 3 years	38	25	13	Thiruvallur followed by Kancheepuram
4 years to 6 years	41	32	9	Kancheepuram followed by Thiruvallur
7 years to 9 years	40	29	11	Thiruvallur
10 years to 12 years	50	41	9	Thiruvallur
Total	169	127	42	

**[Table/Fig-1]:** Categorisation on the basis of age, sex, demography.

Eosinophilia	AEC (Cells per cubic millimetre)	No. of cases
Mild	Above normal to 1500 cells/microliter	138
Moderate	1500 to 5000	29
Severe	More than 5000	2
Total		169

**[Table/Fig-2]:** Categorisation of eosinophilia based on AEC [6-8].

## DISCUSSION

The AEC represents the frequency of circulating eosinophils in the peripheral blood {in cells per microliter (cells/microL)}. The percentage of the eosinophils varies with age, and upper threshold limits are seen in infants and toddlers. Paediatric HE can be associated with a variety of underlying aetiologies. Secondary HE occurs from the polyclonal expansion of eosinophils, through the increased production of IL-3, IL-5, and GM-CSF which promotes increased eosinophil production and survival. Mature eosinophils are released into the bloodstream where they migrate quickly to peripheral tissues of the bronchial and gastrointestinal mucosa and skin.

In this study, 12.6% of the total number of paediatric inpatients was found to have eosinophilia, a study by Bansal R et al., showed about 10.7% of the patients with eosinophilia [10] in a rural set up.

Eosinophilia is prevalent in the paediatric age group from 6 months to 12 years but the highest being 10 to 12 years in the study which accounts for about 30%. By finding the AEC, the degree of eosinophilia was assessed. Mild eosinophilia had maximum number of children followed by moderate and severe eosinophilia.

HE includes both moderate and severe eosinophilia. The causes of persistent HE should be evaluated and corrected to prevent organ damage [3,8].

In the present study, patients, with asthma and UTI had severe eosinophilia. Other studies show the presence of eosinophilia in association with asthma. [11,12]. Studies even revealed that airway eosinophils were found and used as markers in people with severe asthma [12]. Severe eosinophilia in the UTI may be due to infiltration of eosinophils into mucosa, sub mucosa and the child may have eosinophilic cystitis along with UTI [13].

Moderate eosinophilia is seen in various conditions like fever, respiratory infection, gastroenteritis, urinary tract infection, etc., In colitis there is infiltration of eosinophils through the mucosa, sub mucosa of the organ and there is inflammation of the colon [14]. The most common aetiology in moderate eosinophilia cases were pyrexia of unknown origin followed by respiratory system involvement in the present study. Eosinophils were absent in skin in normal conditions but in allergic condition there was infiltration of these eosinophils in the skin [14] which correlates with the index study. Some of the similar studies have been tabulated in [Table/Fig-4] [7,15-17].

Among the Gastrointestinal Disorders, Eosinophilic esophagitis (EoE) is a common cause of HE in the paediatric age group. This diagnosis can often be missed if an appropriate history is not obtained. The primary symptoms are frequent vomiting, food refusal/selective eating, and failure to thrive. As these children increase in age, complaints of abdominal pain and dysphagia increase and adolescents can develop food impactions. Other primary gastrointestinal eosinophilic disorders (eosinophilic gastrointestinal disease) can also cause HE in children, although these disorders are less common than EoE. Additionally, inflammatory bowel disease can be associated with a peripheral eosinophilia.

All children presented to the hospital with HE should undergo a thorough investigation for a possible underlying cause and assessing possible eosinophil-associated end organ damage or dysfunction. The assessment begins with a detailed medical history including an assessment for allergic disorders, such as asthma, eczema, urticaria and hay fever. A history of skin rashes or lymphadenopathy should be sought. Detailed history

Clinical diagnosis/Diseases in system involvement	No. of cases with severe eosinophilia	No. of cases with moderate eosinophilia	No. of cases with mild eosinophilia
Pyrexia of unknown origin		7	25
Respiratory system	Asthma (1)	Asthma (4), Lower respiratory infection (3) Total: 7	Asthma (2), Lower respiratory infection (8), bronchiectasis (1) Total: 11
Gastrointestinal system		Acute colitis (1), Acute gastroenteritis (2) Abdominal pain for evaluation (1) Total: 4	Abdominal pain for evaluation (13) Gastroenteritis (12) Acute colitis (2), Acute gastritis (2), Chronic pancreatitis (1), Constipation for evaluation (1) Total 31
Skin		Urticaria (1), Impetigo (1), Purpura (1), Total: 3	Impetigo (2), Allegry (2) Total: 4
Urinary system	Urinary tract infection (1)	Enuresis (1) Urinary tract infection (1) Total: 2	Urinary tract infection (17) Total: 17
Other causes		Iron deficiency anaemia (1) Lip injury (1) Infected wound (1) Infection Cyst (1), Tetralogy of Fallot (1), Retinoblastoma (1) Total: 6	Anaemia (7), Injury (7), Seizure (4), Cellulitis (3), abscess (3), Osteomyelitis (2), Developmental delay (2), Hydrocoel (2), Hernia (2), Down syndrome (1), Retinoblastoma (1) Cystic nephroma (1), Soft tissue swelling (1), Axillary lymphnode (1), Balanitis (1) Enlargement (1), Unknown bite (1), ITP (1), Headache (1), Arthritis (1), Tongue tie (1) Aortic stenosis (1) Rheumatic heart disease (1) Epistaxis (2) Total: 50
Total	2	29	138

**[Table/Fig-3]:** Clinical diagnosis and system involvement.

Study	Fulkerson PC and Schwartz JT, [7]	Williams KW et al., [15]	Burris D et al., [16]	Kim KM et al., [17]	Present study
Inference	The overall prevalence of HE within the paediatric population still remains unknown, as no population-based studies have been completed.	Largest retrospective cohort analysis and comparing children and adults with HE. 291 subjects evaluated, 37 (13%) were children and 254 were adults (87%). The frequencies of clinical Hypereosinophilic Syndrome (HES) variants were similar between children and adults.	Retrospective chart review with age <18 yr, AEC>1500 cells/cu.mm. Most common cause of HE was secondary HE. Median age at diagnosis was 4.6 years. Median peak AEC was 3,000 cells/cu.mm. HE occurred most frequently in patients aged between 6 and 11 years (24.4%).	Of 8,285 patients who had a haematology profile, 497 (5.9%) were found to have eosinophilia. Of patients with eosinophilia, 333 patients (67.0%) had identifiable and possible causes.	Of 1341 studied 29 (2.1%) cases were found to have moderate eosinophilia and 2 (0.14%) found to have severe eosinophilia. HE occurred most frequently in patients aged between 6 months and 3 years, followed by age group 10-12 years.

**[Table/Fig-4]:** Comparison of inference with other similar studies [7,15-17].

of medications, and travel history to be recorded. To identify the organ system involvement the symptoms such as skin rash, nasal congestion dyspnoea, dysphagia, vomiting, diarrhoea, chest pain and myalgia should be evaluated.

## LIMITATION

Less number of cases were studied.

## CONCLUSION

Paediatric hypereosinophilia remains under recognised, so emphasizing its importance for clinicians will help in narrowing the differential diagnosis and treatment strategy. Initial evaluation for all patients with eosinophilia should be evaluated the organ system involvement by taking complete clinical history, and various symptoms. The clinical setting and results from the initial evaluation should direct further evaluation.

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