Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

ENT

Correlation between Absolute Eosinophil Counts (AEC) and Nasal Symptoms Using NOSE Scale in Allergic Rhinitis

Md. Abul Bashar[1*]

[1]Senior Consultant, Department of ENT, General Hospital, Rangamati, Bangladesh

DOI: 10.36347/sjams.2023.v11i08.013 | **Received:** 21.05.2023 | **Accepted:** 25.06.2023 | **Published:** 17.08.2023

***Corresponding author:** Md. Abul Bashar
Senior Consultant, Department of ENT, General Hospital, Rangamati, Bangladesh

Abstract **Original Research Article**

***Introduction*:** Allergic Rhinitis is a symptomatic disorder of the nose induced after allergen exposure due to an IgE-mediated inflammation of membranes lining the nose. It is clinically defined as a symptomatic condition with four major symptoms as anterior or posterior rhinorrhoea, sneezing, nasal itching & nasal congestion. ***Objective*:** To study the association of absolute eosinophil count (AEC) and nasal symptoms using Nasal obstruction symptom evaluation (NOSE) scale in allergic rhinitis. ***Methods*:** The study was conducted in a General Hospital, Rangamati, Bangladesh over a period of January to June 2021. Patients having symptoms of allergic rhinitis like sneezing, nasal pruritis, rhinorrhoea, nasal congestion, eye watering and itching, pharyngeal itching were included as a part of the study. A detailed clinical examination was performed, NOSE scale form was given to the patient and scoring was done according to the marks on each question, and AEC values were assessed. ***Results*:** Total 125 patients were studied. Groups were made according to AEC value and NOSE score. As per our study patients with higher AEC value have higher NOSE score. ***Conclusion*:** NOSE score evaluation is simple, economical, and non-invasive. Hence it may be used as an alternative for AEC value in clinical setup. Our study indicated that patients with a higher NOSE score with features of allergic rhinitis were having a higher AEC value. However we feel that it is not as accurate as absolute eosinophil count and nasal eosinophilia.

Keywords: AEC (Absolute eosinophil count), AR (allergic rhinitis), NOSE (Nasal obstruction symptom evaluation scale).

Copyright © 2023 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution **4.0 International License (CC BY-NC 4.0)** which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Allergic Rhinitis is a symptomatic disorder of the nose induced after allergen exposure due to an IgE-mediated inflammation of membranes lining the nose. It is clinically defined as a symptomatic condition with four major symptoms as anterior or posterior rhinorrhoea, sneezing, nasal itching & nasal congestion [1-3]. Allergic rhinitis (AR) is a global health problem that has increased rapidly in prevalence over the past few decades [4]. Rhinitis is broadly defined as inflammation of the nasal mucosa. It is a common disorder that affects up to 40% of the population [5]. Allergic rhinitis is the most common type of chronic rhinitis, affecting 10 to 20% of the population, and evidence suggests that the prevalence of the disorder is increasing. Severe allergic rhinitis has been associated with significant impairments in quality of life, sleep and work performance [6]. Evidence has shown that allergen provocation of the upper airways not only leads to a local inflammatory response, but may also lead to inflammatory processes in the lower airways, and this is supported by the fact that rhinitis and asthma frequently coexist [7, 8]. There are a number of physiological, functional and immunological relationships between the upper (nose, nasal cavity, paranasal sinuses, pharynx and larynx) and lower (trachea, bronchial tubes, bronchioles and lungs) respiratory tracts. For example, both tracts contain a ciliated epithelium consisting of goblet cells that secrete mucous, which serves to filter the incoming air and protect structures within the airways. Furthermore, the submucosa of both the upper and lower airways includes a collection of blood vessels, mucous glands, supporting cells, nerves and inflammatory cells. Therefore, allergic rhinitis and asthma appear to represent a combined airway inflammatory disease, and this needs to be considered to ensure the optimal assessment and management of patients with allergic rhinitis [4, 5]. Allergic rhinitis (AR) is an inflammatory nasal airway disease in which production of inflammatory mediators and inflammatory cell infiltration are prominent [8].

MATERIALS AND METHODS

A total of 125 patients who reported at the ENT out-patient department of a General Hospital, Rangamati, Bangladesh from January to June 2021 with signs and symptoms of allergic rhinitis were included in this study. Patients having symptoms of allergic rhinitis – sneezing, nasal pruritis, rhinorrhoea, nasal congestion, eye watering and itching pharyngeal itching were included for this study after taking proper written consent. Patients taking medications for allergic rhinitis, upper respiratory tract infection, vasomotor rhinitis, atrophic rhinitis, pregnant women, tumours of nose and paranasal sinuses were excluded from the study. Routine examination of ear, nose throat was done in all cases. The common signs of allergic rhinitis observed include pale and oedematous nasal mucosa, swollen turbinates and thin, watery or mucoid nasal discharge. Ocular features were oedema of eye lids, congestion of conjunctiva and watering of eyes.

NOSE scale: Nasal obstruction symptom evaluation scale was given to all the subjects who enrolled for this study. After obtaining NOSE score value patients were divided into two groups: 1.

1. NOSE score less than 50
2. NOSE score above 50.

Absolute Eosinophil Count: Blood is drawn from a vein, usually on the inside of the elbow or the back of the hand. The puncture site is cleaned with an antiseptic, and an elastic band is placed around the upper arm. A needle is inserted in to the vein, and the blood is collected in an air-tight vial or a syringe. During the procedure, the band is removed to restore circulation. Once the blood has been collected, the blood is placed on a microscope slide and a stain is added that causes eosinophils to show orange–red granules. The technician then counts how many eosinophils there are per 100 cells. The percentage of eosinophils is multiplied by the white blood cell count to give the absolute eosinophil count.

After obtaining the AEC, patients were divided into three groups:

(A) AEC less than 400
(B) AEC 400- 1000
(C) AEC above 1000.

Statistical Analysis

Pearson correlation method was used in this study. Data was analysed using SPSS software.

RESULTS

Total 125 patients presented to ENT out-patient department during the study period with history and clinical findings suggestive of allergic rhinitis. Among them 57(42.2%) were male and 78(57.8%) were females. As per the NOSE scale we evaluated the patients for symptoms of nasal congestion or stuffiness, nasal blockage or obstruction, trouble in breathing through nose, trouble in sleeping, unable to get enough air through nose during exercise or exertion. NOSE score group one had 62 patients and group two had 63 patients (Table 1). A had 39 patients, Group B had 40 patients, and Group C had 46 patients (Table 2). In group (A), average NOSE score was 36, group (B) score was 45, and group (C) was 60. Patients with NOSE score below 50 were having AEC value upto 1000 & not exceeding 1000. Their NOSE scale marking shows that a higher score leads to nasal blockage or obstruction and unable to get enough air through nose during exercise or exertion. In group (B), patients having NOSE score above 50 had AEC value which was variable from 400 to above 1000 but not having a value below 400. Their NOSE scale marking shows more score to nasal congestion or stuffiness, trouble breathing through nose and trouble sleeping. As the AEC values increased, the NOSE score increases with a Pearson correlation of 0.520 indicating a good correlation and a p value of <0.001 showing significant correlation (Figure 1).

Table 1: The groups of NOSE score Based on AEC, Group (n=125)

	N	%
Group One	62	49.6%
Group Two	63	50.4%

Table 2: The groups of AEC values (n=125)

	N	%
Group A	39	31.2%
Group B	40	32.0%
Group C	46	36.8

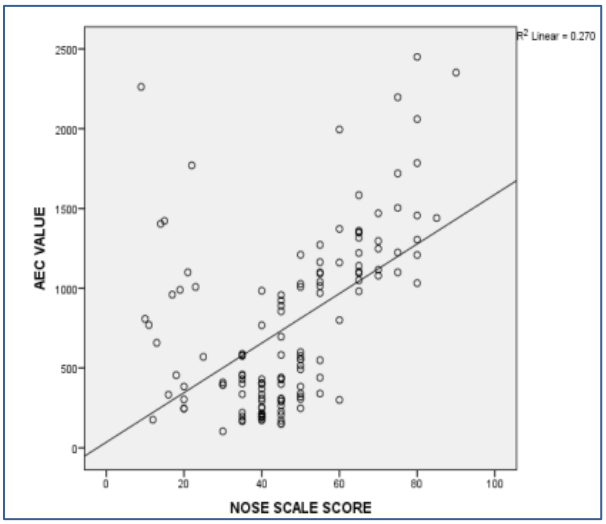

Figure 1: Pearson correlation

DISCUSSION

Rhinorrhoea, pale mucosa and nasal obstruction were common findings in allergic rhinitis. In our present study, patients with a higher score of

NOSE scale had higher AEC values. Nasal eosinophilia was seen in 52.4% cases of allergic rhinitis while blood eosinophilia was seen in 54% of allergic rhinitis [9]. When an allergen is inhaled by a person having a sensitized immune system, the allergen triggers the production of the antibody immunoglobulin E (IgE). Studies suggest that there is evidence that eosinophils are implicated in pathophysiology of allergic respiratory diseases. Thus there is stimulation of mast cells to produce IgE and cytokines which serves as enhancing factors for eosinophilic infiltration in allergic disease [11]. Numerous inflammatory cells, including mast cells, CD4-positive T cells, B cells, macrophages, and eosinophils, infiltrate the nasal lining upon exposure to an inciting allergen (most commonly airborne dust, mite fecal particles, cockroach residues, animal dander, moulds, and pollens). The T cells infiltrating the nasal mucosa are predominantly T helper (Th) 2 in nature and release cytokines (e.g., interleukin [IL]-3, IL-4, IL-5, and IL-13) that promote IgE production by plasma cells. IgE production, in turn, triggers the release of mediators, such as histamine and leukotrienes that are responsible for arteriolar dilatation, increased vascular permeability, itching, rhinorrhea (runny nose), mucous secretion, and smooth muscle contraction [3, 4]. The mediators and cytokines released during the early phase of an immune response to an inciting allergen trigger a further cellular inflammatory response over the next 4 to 8 hours (late phase inflammatory response) which results in recurrent symptoms [4, 8]. The basic investigations required in the evaluation of a patient with suspected AR include complete blood picture with peripheral eosinophil percentage, absolute eosinophil count, total IgE levels, nasal smear examination for eosinophils. Eosinophils are a type of white blood cell. In group (B), patients having NOSE score above 50 had AEC value which was variable from 400 to above 1000 but not having a value below 400. Among them 57(42.2%) were male and 78(57.8%) were females. In group (A), average NOSE score was 36, group (B) score was 45, and group (C) was 60. Patients with NOSE score below 50 were having AEC value upto 1000 & not exceeding 1000. NOSE score group one had 62 patients and group two had 63 patients. A had 39 patients, Group B had 40 patients, and Group C had 46 patients. The exact role of eosinophils in human body is unclear, but eosinophils are usually associated with allergic diseases and certain infection. The association between eosinophil and allergic disease has been published in various studies. A correlation between the degree of AR and peripheral blood eosinophilia has been observed in subjects who exhibited a dual response following allergen challenge [9]. Airway inflammation is present in the upper airways, but with little collagen deposition and absence of myofibroblasts in the nasal mucosa [10]. There is evidence of remodelling in the nasal mucosa [11]. The inflammation in the nasal mucosa is dominated by esoinophils which accumulate in the reticular basement membrane and there is epithelial shedding, though not to the same degree as in the bronchi of patients with allergic asthma [12]. It has also been suggested that neural pathways may contribute to the pathophysiology of allergic rhinitis [13]. Neurotropins, and nerve- growth factor (NGF) expressed in the eosinophils in the nasal mucosa has been suggested as candidates for the nasal hyper-responsiveness [14]. Nasal obstruction is mostly the result of dilatation of capillary vessels, whereas bronchial obstruction is mainly caused by smooth muscle contraction. Allergic rhinitis is the most frequent manifestation of allergic disease affecting the airways and its development depends on the interaction between genes, environment and immunological factors. The diagnosis of rhinitis is based on the report of subjective nasal complaints (nasal blockage, itching, sneezing and increased secretions), increased nasal responsiveness and increased nasal airway resistance. To date, the different tests for rhinitis have low sensitivity and specificity and the diagnosis is therefore predominately made on the basis of clinical history [14, 15]. The immediate reaction can subside but generally proceeds to the latephase reaction, giving rise to chronic inflammation with more serious long-term illness in the affected tissue [16-18]. The eosinophil is a multifunctional leukocyte involved in inflammatory reactions, parasite defence and in immune modulating responses [19]. A hallmark of allergic disease is infiltration of the target tissue with increased numbers of eosinophils besides a variety of chronic changes due to remodelling [20]. The migration of eosinophils to the site of inflammation, where they perform their end-phase effector functions, is mediated by the cytokines, chemokines and adhesion molecules. The human eosinophils have highly condensed nuclear chromatin and two major types of granulae, specific and primary. Specific granulae have a distinct core and contain cationic proteins, the primary granulae are formed early in the development and are enriched with Charcot-Leyden Crystal protein (CLC). In addition, the eosinophils contain cytoplasmic lipid bodies, synthesising eicosanoids. The major cationic proteins in the specific granule are major basic protein (MBP), eosinophil cationic protein (ECP), eosinophil peroxidase (EPO) and eosinophil protein X (EPX)/eosinophil derived neurotoxin (EDN) all of which are extremely toxic to tissues [21, 22]. The eosinophils express an array of cell-surface proteins, including Igreceptor for IgG, IgA, complement receptors, leukotriene receptors, prostaglandin receptors, PAF receptor and TLRs as well as several inhibitory receptors. Although global quality-of-life and health status instruments are an important part of health status assessment, for many conditions the changes in health status are too subtle or disease specific to be assessed using the content of a global instrument. Therefore disease-specific health status instruments are needed [23]. Like many similar instruments, the NOSE Scale was validated for use in groups of patients. Therefore it could be used for comparing disease-specific health status between groups of patients before

and after treatment, or used to compare the effects of different treatments. Similarly, it could be used to assess differences in outcome when different surgical techniques are used. It could also be used to compare symptom severity between different groups of patients, for example, those with and without nasal polyps. However, it was not designed to be used with individual patient data or to predict outcome in individuals.

CONCLUSION

NOSE score evaluation is simple, economical, and non-invasive. Hence it may be used as an alternative for AEC value in clinical setup. In this study it showed that patients with a higher NOSE score with features of allergic rhinitis were having a higher AEC value. However we feel that it is not as accurate as absolute eosinophil count and nasal eosinophilia.

Conflict of Interest: None.
Source of Funding: Nil.

REFERENCES

1. Meltzer, E. O. (2001). Quality of life in adults and children with allergic rhinitis. *J Allergy Clin Immunol*, *108*(Suppl 1), S45–S53.
2. Bousquet, J., Van Cauwenberge, P., Ait Khaled, N., Bachert, C., Baena-Cagnani, C. E., Bouchard, J., ... & Yusuf, O. (2006). Pharmacologic and anti-IgE treatment of allergic rhinitis ARIA update (in collaboration with GA2LEN). *Allergy*, *61*(9), 1086-1096.
3. Stokes, M., Amorosi, S. L., Thompson, D., Dupclay, L., Garcia, J., & Georges, G. (2004). Evaluation of patients' preferences for triamcinolone acetonide aqueous, fluticasone propionate, and mometasone furoate nasal sprays in patients with allergic rhinitis. *Otolaryngology—Head and Neck Surgery*, *131*(3), 225-231.
4. Asher, M. I., Montefort, S., Björkstén, B., Lai, C. K., Strachan, D. P., Weiland, S. K., & Williams, H. (2006). Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. *The lancet*, *368*(9537), 733-743.
5. Small, P., Frenkiel, S., Becker, A., Boisvert, P., Bouchard, J., Carr, S., Schellenherg, B., … & The Canadian Rhinitis Working Group. (2007). Rhinitis: A Practical and Comprehensive Approach to Assessment and Therapy. *Journal of otolaryngology*, *36*(Suppl 1), S5-S27.
6. Dykewicz, M. S., & Hamilos, D. L. (2010). Rhinitis and sinusitis. *J Allergy Clin Immunol*, *125*, S103-115.
7. Wilson, A. M., O'Byrne, P. M., & Parameswaran, K. (2004). Leukotriene receptor antagonists for allergic rhinitis: a systematic review and meta-analysis. *Am J Med*, *116*(5), 338–344.
8. Kämpe, M., Stolt, I., Lampinen, M., Janson, C., Stålenheim, G., & Carlson, M. (2011). Patients with allergic rhinitis and allergic asthma share the same pattern of eosinophil and neutrophil degranulation after allergen challenge. *Clinical and Molecular Allergy*, *9*(1), 1-10.
9. Bourdin, A., Gras, D., Vachier, I., & Chanez, P. (2009). Upper airway· 1: Allergic rhinitis and asthma: united disease through epithelial cells. *Thorax*, *64*(11), 999-1004.
10. Tran, N. P., Vickery, J., & Blaiss, M. S. (2011). Management of rhinitis: allergic and non-allergic. *Allergy, asthma & immunology research*, *3*(3), 148-156.
11. Kumar, N., Bylappa, K., Ramesh, A. C., & Reddy, S. (2012). A study of eosinophil count in nasal and blood smear in allergic respiratory diseases in a rural setup. *Internet Journal of Medical Update-EJOURNAL*, *7*(1), 40-6.
12. Stewart, M. G., Witsell, D. L., Smith, T. L., Weaver, E. M., Yueh, B., & Hannley, M. T. (2004). Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) scale. *Otolaryngology—Head and Neck Surgery*, *130*(2), 157-163.
13. Bousquet, J., Vignola, A. M., & Demoly, P. (2003). Links between asthma and rhinitis. *Allergy*, *58*, 691-706.
14. Shaaban, R., Zureik, M., Soussan, D., Neukirch, C., Heinrich, J., Sunyer, J., ... & Leynaert, B. (2008). Rhinitis and onset of asthma: a longitudinal population-based study. *The Lancet*, *372*(9643), 1049-1057.
15. Chanez, P., Vignola, A. M., Vic, P., Guddo, F., Bonsignore, G., Godard, P., & Bousquet, J. (1999). Comparison between nasal and bronchial inflammation in asthmatic and control subjects. *American journal of respiratory and critical care medicine*, *159*(2), 588-595.
16. Gel, P. G. H., & Coomb, R. R. A. (1963). Clinical aspect of Immunology. 1 st ed. Oxford, England, Blackwell.
17. Togias, A. (2004). Systemic effects of local allergic disease. *J Allergy Clin Immunol*, *113*, S8-14.
18. Nielsen, L. P., Peterson, C. G., & Dahl, R. (2009). Serum eosinophil granule proteins predict asthma risk in allergic rhinitis. *Allergy*, *64*, 733-7.
19. Stone, K. D., Prussin, K., & Metcalfe, D. D. (2010). IgE, mast cells, basophils and eosinophils. *J Allergy Clin Immunol*, *125*, S73-80.
20. Paul Ehrlich the Nobel Prize in Medicin 1908.
21. Wenzel, S. E. (2009). Eosinophils in asthma–closing the loop or opening the door? *NEJM*, *360*, 1026-28.
22. Hogan, S. P., Rosenberg, H. F., Moqbel, R., Phipps, S., Foster, P. S., Lacy, P., ... & Rothenberg, M. E. (2008). Eosinophils: biological properties and role in health and disease. *Clinical & Experimental Allergy*, *38*(5), 709-750.
23. Venge, P. (2010). The eosinophil and airway remodelling in asthma. *Clin Respir J*, *4*(S1), 15- 9.