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ORIGINAL ARTICLE

The evaluation of neutrophil–lymphocyte ratio in children with asthma

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KEYWORDS
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Abstract
Background: Neutrophil–lymphocyte ratio (NLR) is a test used to evaluate the systemic inflammation. There is little knowledge about the neutrophil–lymphocyte ratio in asthmatics. In our study, we aimed to evaluate NLR and to assess its relationship with clinical parameters in children with asthma.
Methods: Four hundred and sixty-nine children diagnosed with asthma and followed in our hospital were included in the study. The control group included 170 children with no evidence of allergic disease (i.e. asthma, allergic rhinitis, eczema) or infection. Skin prick tests were performed using the same antigens for all patients. The immunoglobulin E levels and complete blood count were measured.
Results: There was no difference between the groups with regard to gender and age. Mean NLR was 2.07 ± 1.41 in the study group and 1.77 ± 1.71 in the control group. The difference was statistically significant ($p = 0.043$). There was no statistically significant difference between NLR and gender, familial atopy, exposure to smoke, sensitivity to allergens ($p > 0.05$). While mean NLR was weakly positively correlated with number of hospitalisations (r: 0.216; p: 0.012), the percentage of eosinophils was weakly negatively correlated with NLR (r: −0.195; p: 0.001).
Conclusion: Mean NLR is higher in asthmatic children compared to control group. We think that NLR could be used for the evaluation of systemic inflammation in asthmatic patients. However, further studies are needed to assess airway and systemic inflammation as well as NLR in patients with asthma.

Introduction

Asthma is a chronic respiratory disease which affects 1–18% of the population in different countries. It is defined as a chronic inflammation of airways characterised by increased

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responsiveness of bronchials to a variety of stimuli. It is characterised by recurrent attacks of cough, wheezing, dyspnoea and by variable expiratory airflow limitation.[1] In addition to airway inflammation, there is a systemic inflammation in asthma. The increased circulating proinflammatory cytokines, such as interleukin (IL)-6 and tumour necrosis factor-α (TNF-α) play a role in this inflammation. These proinflammatory cytokines in asthmatic patients increase in immune cells, such as neutrophils and natural killer cells, and stimulate hepatic production of acute-phase proteins, such as C-reactive protein (CRP). C-reactive protein is known to be a sensitive marker of low-grade systemic inflammation.[2,3] C-reactive protein is the most commonly used marker to evaluate the systemic inflammation in patients with asthma.[3–9] Results with CRP levels in patients with asthma are inconsistent. Although some studies showed no difference in comparison with the control group,[3,4] there are also some studies that observe CRP levels as higher in asthmatics than the control group.[5–9] In addition to CRP, other acute phase reactants such as serum amyloid A and fibrinogen were evaluated in assessing the systemic inflammation in patients with asthma.[5]

Neutrophil–lymphocyte ratio (NLR) could be an important measure of systemic inflammation as it is readily available, cost effective and could be calculated easily. NLR may reflect ethnicity, neurohumoral activation, renal dysfunction, thyroid disease, hepatic dysfunction, nutritional deficiencies, bone marrow dysfunction, inflammatory diseases, chronic or acute systemic inflammation.[10] NLR has been associated with some conditions such as chronic inflammation in cardiovascular diseases, hypertension, diabetes mellitus, malignancies, FMF, hepatic cirrhosis, and Behcet Disease, and it has been suggested that NLR has a prognostic importance.[11–16] There is also a chronic inflammation in asthma. Cytokines in the pathogenesis of asthma cause an increase in neutrophils, as noted above.[3] Based on this information, we think that the neutrophil–lymphocyte ratio is increased in asthmatics. However, our knowledge about NLR in asthmatic patients is less.[11,17] While one of these studies performed in adults, showed no relationship between asthma and NLR,[11] NLR was found to be associated with neutrophilic asthma in the other study.[17]

In our study, we aimed to evaluate NLR and to assess its relationship with clinical parameters in children with asthma.

Methods

Four hundred and sixty-nine children with asthma, followed in the Paediatric Allergy and Immunology Department of a public hospital of Obstetrics and Paediatrics, were included in the study. Patients were evaluated retrospectively between September 2012 and November 2014. The control group included 170 children with no evidence of allergic disease (i.e. asthma, allergic rhinitis, eczema) or infection.

Patients who have had an exacerbation of asthma, receiving systemic steroids within the last month, acute/chronic infection, and patients with any other systemic disease such as hepatic, renal, cardiovascular diseases, diabetes mellitus, cancer and systemic inflammatory disorders were excluded. In addition, patients with anaemia/polycythemia, leukopenia/leukocytosis, and thrombocytopenia/thrombocytosis in complete blood count analysis were excluded from the study. Neutrophil–lymphocyte ratio may be changed by medications such as Nebivolol.[18] Therefore, patients receiving Nebivolol were excluded. A detailed allergic history, including the age, a familial atopy history, and exposure to cigarette smoke were recorded. Familial atopy was accepted as positive when having allergic disease in first degree relatives (parents and siblings). The diagnosis of asthma was evaluated according to the GINA guidelines.[1] The immunoglobulin (Ig) E levels and complete blood count were measured. The study was approved by the Zeynep Kamil Woman's and Children's Diseases Training and Research Hospital Ethics committee and an oral consent was obtained from all subjects and/or their parents.

Skin prick tests

Skin prick tests were performed using the same antigens for all patients. Patients were considered eligible for the skin test if they have not received antihistamines for at least one week. Skin prick tests were applied on the anterior forearm. Histamine (10 mg/ml) and physiological saline were used as positive and negative controls, respectively. Skin reactions were evaluated at the 15th minute of the application, and indurations $\geq$3 mm were considered as a positive reaction. Skin prick tests for common aeroallergens (*Dermatophagoides pteronyssinus, Dermatophagoides farinea*, grass mix, cereal mix, tree mix, weed mix, *Alternaria alternaria*, cockroaches, cat dander and dog dander (Stallergenes SA, 92160 Antony, France) were performed by using stallerpoint (Stallergenes SA, 92160 Antony, France).

Laboratory analysis

Haemoglobin, platelet, leucocyte, neutrophil, and lymphocyte count measurements were performed within approximately 60 min after blood sampling with Coulter LH 780 Analyzer and Coulter Hmx Haematology Analyzer (Beckman Coulter, Inc., CA, USA) with original method and reagents. Neutrophil–lymphocyte ratio was calculated by dividing the percentage of neutrophils and lymphocytes in complete blood count analysis.

Statistical analyses

Statistical Package for Social Sciences (SPSS for Windows 15.0, Chicago, USA) programme was used to analyse the data. Results were given as either mean $\pm$ standard deviation (SD) or as mean $\pm$ standard deviation (median) according to the distribution. Student's *t* test was used for the comparison of normally distributed variables. Chi-square and Mann–Whitney *U* tests were used for non-normally distributed variables. Pearson's correlation test was used for the correlation analyses of continuous variables. $p < 0.05$ was considered as significant.