

## Diagnostic Value of Neutrophil-to-Lymphocyte Ratio in Allergy Patients

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### ABSTRACT

**Objective:** To investigate the relationship between the neutrophil-to-lymphocyte ratio (NLR) and the clinical characteristics of the acute allergic reaction patients diagnosed in an emergency clinic.

**Methods:** The medical records of the patients with a diagnosis of acute allergic reactions that were presented to Dicle University Medical Faculty Hospital Emergency Department, Diyarbakır, Turkey, between January 1, 2014 and December 31, 2014 were included in the study. The age, gender, NLR, white blood count, eosinophil, mean platelet volume (MPV), glucose, and the platelet count of all the participants were recorded. The study included 100 allergy patients and 100 healthy control group subjects. The demographic and the clinical characteristics of the groups were compared using statistical analyses.

**Results:** The mean age, gender, lymphocyte count, eosinophil count, platelet count, and MPV were similar in the two groups ( $p > 0.05$  for all). The mean NLR values of the allergy and the control group were 4.36 and 2.12, respectively ( $p = 0.008$ ). Moreover, the serum glucose levels were significantly higher in the allergy group compared with the control group ( $p < 0.001$ ).

**Conclusion:** The patients with acute allergic reactions had a significantly higher value of NLR. Thus, NLR may be a useful diagnostic indicator of allergic conditions.

**Keywords:** Allergy, inflammation, neutrophil-to-lymphocyte ratio.

### INTRODUCTION

An allergy is a special type of severe reaction involving antibody and/or cell-mediated immune mechanisms. It generally occurs in response to non-pathogenic substances. The severity of allergic reaction may vary depending on the dose of allergen involved, the allergen's route of entry into the body, the presence of additional environmental micro-organisms, and the individual's genetic composition (1). Most allergic and inflammatory diseases derive from IgE-mediated mechanisms. After various studies had shown that neutrophilic inflammation was associated with the severity of asthma, research began on neutrophil migration to the region of inflammation. Recent studies had shown that that cytokine IL-17 released from Th 17 cells played a significant role in neutrophilic inflammation. Studies using animal models had shown that Th17 cells, together with Th2

cells, caused neutrophilic inflammation and excessive airway sensitivity (2, 3).

Neutrophils and lymphocytes are blood cells with important roles in inflammatory events. The changes in the numbers of these cells may be observed during inflammation. When an allergen is encountered, neutrophils are the first inflammation cells to migrate to the area of inflammation. Produced in bone marrow and short-lived, neutrophils migrate to the area of inflammation by entering the circulation in approximately 1 hour (4). This results in a rise in the number of neutrophils in the blood. The neutrophil-to-lymphocyte ratio (NLR) has been described as a prognostic factor and the marker of inflammation in various diseases, such as cardiovascular diseases (5, 6) and cancers (7). However, the manner in which the NLR changes in allergies, and other inflammatory conditions, is not known.

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Since there are no previous studies on this subject, the purpose of this study was to investigate the association between NLR and progression of the disease in the cases of acute allergic reactions.

## SUBJECTS AND METHODS

The medical records of the patients admitted to the Dicle University Medical Faculty Research Hospital Emergency Department between January 1 and December 31, 2014 who developed systemic or local acute allergic symptoms for any reason (such as skin red- dening, swelling, itching, urticaria, eczema, angioedema, swollen throat, respiratory difficulty, sneezing, coughing and watery eyes, or nausea, vomiting, pain and diarrhoea involving the gastrointestinal system) were examined retrospectively. The study was performed in accordance with the Helsinki Declaration, and the Dicle University Medical Faculty Non-Interventional Clinical Research Ethical Committee granted approval (25.11.2014, no. 2014/415). A control group was established by examining the file records of the healthy volunteers who had donated blood to the blood bank.

Their demographic data, such as age and gender and their laboratory data including NLR, lymphocyte, eosinophil, mean platelet volume (MPV), glucose, and platelet values, were recorded. The patients with any systemic or local disease (with the exception of acute allergic reaction), infection or clinical conditions that might affect the full blood parameters were excluded from the study. Their NLR was calculated based on haemogram results for all the patients.

The patients' haemograms (MPV, platelets, lymphocytes, monocytes, basophils, neutrophils, and eosinophils) were investigated on an Abbott CELL DYN 3700 (USA) device. Their biochemical parameters (glucose) were investigated using the colorimetric method with an Abbott kit on an Abbott C16000 device.

The 'Statistical Package for the Social Sciences 18' software (SPSS Inc, Chicago, IL, USA) was used for the statistical analyses. Student's *t*-test was used for normally distributed data as revealed by the Kolmogorov-Smirnov test. The Mann-Whitney *U* test was used for the non-normally distributed data. The Chi-squared test was done for the categorical comparisons.

## RESULTS

A total of 100 patients with acute allergy and 100 control group cases were evaluated. The male to female ratio was 40:60 in the allergy group and 47:53 in the control group ( $p = 0.28$ ). The demographic and laboratory

characteristics of the groups are summarized in the Table. The neutrophil numbers and NLR were significantly higher in the acute allergy group in our study compared with the control group. The blood glucose levels were also significantly higher in the group diagnosed with allergic diseases compared with the control group.

Table: Comparison of the clinical and demographic parameters among the patient and control groups

	Allergy (n = 100)	Control (n = 100)	<i>p</i>
Age (year ± SD)	41.2 ± 16.9	38.4 ± 14.5	0.23
Male/female (n)	40/60	47/53	0.28
Neutrophils (K/μL)	6.66 ± 3.80	4.65 ± 2.03	< 0.001
Lymphocytes (K/μL)	2.41 ± 1.22	2.48 ± 1.43	0.73
NLR	4.36 ± 8.24	2.12 ± 1.07	0.008
Eosinophils (K/μL)	0.22 ± 0.33	0.28 ± 0.75	0.44
Glucose (mg/dL)	119.2 ± 50	99.1 ± 28	< 0.001
MPV (fL)	8.72 ± 1.89	8.80 ± 1.59	0.74
Platelet (10 <sup>3</sup> K/μL)	272.7 ± 77.0	293.78 ± 94.6	0.85

SD = standard deviation; NLR = neutrophil lymphocyte rate, MPV = mean platelet volume.

## DISCUSSION

Our review of the literature revealed that there were no previous investigations of the NLR in the cases of acute allergy. The neutrophil numbers and NLR were significantly higher in the acute allergy group in our study compared with the control group. The blood glucose levels were also significantly higher in the group diagnosed with allergic diseases compared with the control group.

The use of the NLR as a marker of inflammation has become increasingly popular. One study reported a higher NLR in young patients with acute coronary syndrome with no ST elevation compared with the control group (8). Another study revealed no significant difference in the NLR between coronary artery disease the patients with weak collateral circulation and patients with well-developed coronary collateral circulation (9). In cases of tuberculous pleurisy, in which inflammation was involved, the investigation of pleural fluid adenosine deaminase activity and NLR had been reported to make a significant contribution to the diagnosis (10). In addition, one study reported higher NLR values in the patients with psoriasis compared with the control group (11). The significance of NLR in our study derives from the significant change in the neutrophil numbers ( $p < 0.001$ ), because no significant change was observed in the lymphocyte numbers ( $p = 0.73$ ).

Some studies had reported an increase in neutrophil and eosinophil numbers towards the late phase after rapid response in the allergic reactions (1). The neutrophil numbers in the blood collected from the veins of the patients on their admission to our emergency clinic were significantly higher in the acute allergy group compared with the control group. This might be attributed to neutrophil infiltration in the acute period.

An increase in the eosinophil numbers had been reported in allergic reactions. However, since the IL-4 pathway was activated in allergic reactions in association with drugs and non-helminthic agents, no significant change was observed in the eosinophil levels.

Neutrophil-to-lymphocyte ratio had been used as an inflammatory marker in studies on various diseases. An inflammatory process was involved in allergy cases. Neutrophil-to-lymphocyte ratio levels were significantly higher in the allergy patients than in the control group in our study. The significant NLR elevation resulted from an increase in the neutrophil numbers. Since allergic reactions are generally type 1 hypersensitivity reactions, an increase in the lymphocyte numbers in the early period is not generally expected in these cases.

The allergies and stress in the body also cause an increase in the glucose levels. The blood glucose levels can change in the patients with a diagnosis of acute allergic reactions, due to anaphylaxis-related stress and steroid therapy. This might have accounted for the elevated blood glucose levels in the allergy group compared with the control group in our study.

In conclusion, the significantly high NLR in acute allergic reaction cases in this study suggested that it might be a useful diagnostic parameter in allergic reactions. Prospective randomized clinical studies with larger case numbers are now needed to examine the association with other parameters that can affect NLR.

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