Original Article

Eurasian Journal of Critical Care

Evaluation of Patients with Corona Disease in the City Hospital

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Abstract

Background: Monitoring the values of eosinophils in particular among the blood cell count (CBC) parameters of patients who experienced COVID-19 and then worsened and become ex, highlights the importance of the mortality caused by the disease, and by early diagnosis, the necessary measures can be taken.

Methods: Our study is retrospective case control study. The clinical and laboratory data of 1039 patients who received a diagnosis of COVID-19 between March 11th and September 11th, 2020.

Results: The study was completed with a total of 1039 patients. Of the participants, 378 (36.4%) were female and 661 (63.6%) were female. The number of people who died from the disease was 172 (16.6%). Of the deceased patients, 63 were female. The mortality rate was higher in male patients, at 63.37%. Severe eosinopenia was found in 77.02% of the deceased patients. The number of eosinophil cells in surviving patients were very weak compared to the others, while the number of monocytes and lymphocytes in deceased patients were correlated.

Conclusion: Close monitoring of CBC parameters, particularly eosinophils, can be helpful in the early screening, treatment, and follow up of critically ill COVID-19 patients in terms of mortality

Keywords: COVID-19, eosinopenia, mortality, early diagnosis

Introduction

In December 2019, a new coronavirus disease called COVID19, characterized by dry cough, fever, fatigue, and lung involvement, was detected in patients in the city of Wuhan, China (1). It has been seen that laboratory tests used in the morbidity, severity, mortality, and follow up of COVID-19 patients are extremely important (2). The clinical course of these patients varies from asymptomatic to serious and fatal findings (3). Eosinophils are important leukocytes in tissue or periphery, which have proinflammatory effects in many diseases. In particular, their immune regulatory and antiviral functions have been shown in recent years (4). It is thought that the eosinopenia seen in COVID-19 is also effective due to the inhibition of the production and eosinophilopoiesis of type 1 interferons in the bone marrow as a result of the effective factors (5). Eosinophils have also shown antiviral immune responses to respiratory viruses such as respiratory syncytial virus and influenza (5). Eosinophils recognize various toll-like receptors (TLRs), such as TLR-3, TLR-7, TLR-9, which play a role in identifying viruses (6). Eosinophiles have the ability to block viral replication by producing nitric oxide (NO) with the help of inducible nitric oxide synthase (7). In recent years, it has been shown that peripheral blood eosinophil count is an effective and sufficient indicator in the diagnosis, evaluation, and prognosis of COVID-19 patients (8).

Materials and Methods

Our study is a retrospective case control study. After getting the approval of the Ethics Committee (Fırat university 2020/14-16), the study was completed with a total of 1039 patients diagnosed with COVID-19 between March 11th and September 11th, 2020. Statistical analyzes were

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• **Received:** 24.02.2025 • **Revision:** 12.03.2025 • **Accepted:** 02.05.2025
DOI: 10.55994/ejcc.1645847

Cite this article as: Canpolat O. Evaluation of Patients with Corona Disease in the City Hospital. Eurasian Journal of Critical Care. 2025;7(1): 13-17

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Table 1. Statistical distribution of age and gender between recovered and deceased patients

	Ex- Trimmed Mean (5%)	Right - Trimmed Mean (5%)	Ex- Median	Right - Median	Ex- Minimum-Maximum	Right - Minimum-Maximum	P Value
AGE	74,32	74,16	75,00	75,00	28-101	28-100	0.855
BA	0,04	0,04	0,03	0,04	0-0,26	0-0,25	0.003
%BA	0,40	0,56	0,36	0,52	0-1,62	0,01-4,47	<0.001
EO	0,02	0,07	0,01	0,04	0-0,47	0-3,4	<0.001
%EO	0,17	0,89	0,05	0,54	0-3,95	0-23,75	<0.001
MO	0,59	0,66	0,51	0,62	0,03-2,48	0,01-6,37	0.001
%MO	6,44	8,72	5,91	8,44	0,54-17,98	0,46-41,57	<0.001
LE	1,02	1,44	0,83	1,36	0,18-6,3	0,2-21,17	<0.001
%LE	12,50	20,51	10,73	20,16	1,29-60,08	1,31-75,76	<0.001
NE	8,23	5,52	7,31	4,92	0,08-42,79	0,08-31,99	<0.001
%NE	80,12	68,61	81,73	67,95	25,44-97,43	8,65-95,73	<0.001
WBC	10,13	7,91	9,05	7,30	0,3-45,1	0,9-36,3	<0.001
RBC	4,58	4,67	4,60	4,70	2,18-6,18	1,81-7,06	0.109
PLT	217,52	213,49	201	206	85-547	42-928	0,919
NELE	10,05	4,79	7,79	3,36	0,44-75,78	0,15-70,29	<0.001

performed using IBM SPSS statistics. The distribution of the data was determined by the Kolmogorov-Smirnov test. Continuous variables were expressed as median (minimum maximum), and categorical variables were expressed as frequency and percentage. Continuous variables were compared using the Mann-Whitney U test. The linear relationship between two continuous blood test variables was evaluated using the Spearman correlation analysis. Results were evaluated at a 95% confidence level, and a P value less than 0.05 was considered statistically significant for all tests. There were 378 (36.4%) female patients and 661 (63.6%) male patients. The number of patients who recovered from the disease was 867 (83.4%), and the number of deaths was 172 (16.6%).

This study did not find a statistically significant difference in terms of age and gender distribution between recovered and deceased patients in this population (Table 1).

There were 63 female and 109 male deceased patients, and 315 female and 552 male recovering patients. The mortality rate was higher among male patients, with only 36.63% of the deceased being female. When evaluating the percentage of eosinophiles among the deceased and surviving patients, 77.02% of the deceased had severe eosinopenia, while the rate was 35.41% among surviving patients. Among patients with lymphopenia and severe eosinopenia, 81% had lost their lives. In patients who died but were not lymphopenic, the rate of severe eosinopenia was approximately 70%. The number of patients discharged with a lymphocyte count above 1.11 was 549 (63.32%). The number of patients discharged a non-lymphopenic and eosinophil percentage below 0.25 was 134 (24.41%). The number of patients discharged with a non-lymphopenic and eosinophil percentage above 0.25 was 415 (75.59%). The number of patients discharged with a lymphocyte count below 1.11 was 318 (36.68%). The number of patients discharged with a lymphopenic and eosinophil percentage below 0.25 was 173 (54.40%). The number of patients discharged with lymphopenic and eosinophil percentage above 0.25 was 14 (45.60%). The number of patients discharged with a lymphocyte count above 1.11 and ex was 49 (31.06%). The number of patients discharged with a non-lymphopenic and eosinophil percentage below 0.25 and ex was 34 (69.39%) the number of patients with a non-lymphopenic and eosinophil percentage above 0.25 who became ex was 15 (30.61%). The number patients with a lymphocyte count below 1.11 who became ex was 11 (68.94%). The number of patients with a lymphopenic and eosinophil percentage below 0.25 who became ex was 90 (81.08%). The number of patients with a lymphopenic and eosinophil percentage above 0.25 who became ex was 21 (18.92%). Among patients who recovered with a non-lymphopenic and eosinophil percentage below 0.25, the number with a monocyte percentage below 6 was 26 (4.46%), while among those who died, the number with a monocyte percentage below was 21 (61.76%). Among patients who recovered with a non-lymphopenic and eosinophil percentage above 0.25, the number with a monocyte percentage below 6 was 48 (11.57%), while among those who died, the number with a monocyte percentage below 6 was 3 (20%). There was a correlation between the total number of leukocytes and the number of other cells besides lymphocytes. In recovered patients, the number of basophils had a weak correlation with the number of eosinophils, monocytes, lymphocytes,

and neutrophils, while in deceased patients, this correlation partially increased. In recovered patients, the number of eosinophils had an almost non-existent correlation with the others, while in deceased patients, it correlated with the number of monocytes and lymphocytes.

Conclusion

Eosinophil levels in critically ill COVID-19 patients, who experience progression of the disease, were found to be significantly lower than in those with moderate or severe disease. No significant difference was observed in eosinophil counts (normal range: 0.02-0.52 x 109/L) or ratios (normal range: 0.4-8%) between moderate or severe COVID-19 patients.

Eosinophil counts and ratios were significantly lower in critically ill COVID-19 patients compared to those with moderate or severe disease. A higher number of male COVID-19 patients with critical illness was observed. And these male patients had significantly lower eosinophil counts compared to female patients. A progressive decline in eosinophil levels was observed in relation to mortality in COVID-19 patients, with deceased patients having significantly lower eosinophil counts compared to surviving patients.

Discussion

Progressive worsening of eosinophilia has been associated with the progression of critical illness in COVID-19 patients and with a higher risk of serious mortality. Eosinophilia has also been linked to damage in the liver, kidneys, and other tissues. As well as to coagulation disorder. Eosinophils, which have strong proinflammatory effects, are produces in bone marrow and defend against extracellular agents using toxic proteins in their granules. It has been reported that eosinophil counts decrease by 50-70% in severe COVID-19 patients (9).

Eosinophilia, or an increase in eosinophil count in the blood, is associated with parasitic infections and asthma. Some studies have shown that eosinophils, which protect against parasites, also have harmful effects in severe asthma patients. Eosinophils have been shown to have antiviral activity in studies with mice (7,10). Humanized anti-IL-5 monoclonal antibody (mepolizumab) has been shown to increase viruses in humans and mice (11,12) while reducing eosinophil counts and treating eosinophilic asthma. The capture function of eosinophils for viruses has been shown to be reduced in severe asthma patients (10). In asthma exacerbations related to viruses, it is thought that eosinophil counts and anti-viral function are important in fighting viruses. Eosinophils may contribute to antiviral immunity. When eosinophils are activated by the virus, they release neurotoxin/ribonuclease 2 and cationic proteins (which kill the virus) (13). Eosinophil interaction occurs with cluster of differentiation (CD) CD86 and CD80. When eosinophils are infected with Influenza A virus, they behave like professional antigen-presenting cells and elicit antiviral immunity through CD8+ T cell-associated in vivo (7). This is an important event because if eosinophils also play a role in immunity against SARS-CoV-2, correcting the eosinopenia present in COVID-19 patients could be a significant development in preventing mortality. Our study is a retrospective case-control study. 81% of patients with lymphopenia and marked eosinopenia died. The rate of marked eosinopenia in patients who died but were not lymphopenic was approximately 70%. In a retrospective study of COVID-19 patients by Chen et al., it was found that eosinophil counts significantly decreased in critically ill and fatal patients (14). In a study by Lu G et al., the eosinophil count in severe COVID-19 cases was significantly lower than in moderate cases (15,16). Zhao et al., have also found a significant relationship between eosinopenia and the severity of COVID-19 (17). In our study, there was also a significant relationship between the number of patients who recovered from COVID-19 and eosinopenia. The decrease in eosinophil levels (eosinopenia) was a significant finding between SARS- CoV-2 infection. The relationship between eosinopenia and the severity of COVID-19 has not been observed in previous studies (18). In this study, we found that eosinophil levels in patients with severe COVID-19 were significantly lower compared to those with moderate of milt disease. We also found that the progressive decline in eosinophil levels was associated with mortality in COVID-19 patients. These findings suggest that eosinopenia may be a guiding factor in the treatment of COVID-19. Additionally, our study demonstrated that the progressive decline in eosinophil levels was associated with mortality in COVID-19 patients, which was supported by other findings in this study. A study of critically ill COVID-19 patients showed that thrombotic disorders were also present (19). The numbers and ratios of eosinophils were inversely correlated with some biomarkers of tissue damage in patients with severe COVID-19. It thought that eosinopenia is associated with organ failure and tissue damage. The emerging concept that eosinophils support tissue repair supports this observation (20-22). In this study, we demonstrate that eosinophil levels in critically ill COVID-19 patients are significantly lower than in those with moderate or severe disease. We also found that the progressive decrease in eosinophil levels was associated with mortality

in COVID-19 patients. Our study suggests that eosinopenia may be a guide in the treatment of COVID-19. Additionally, our study has systematically analyzed the relationship between the severity of eosinopenia and the severity of COVID-19 disease. We believe that a detailed eosinophil analysis is necessary in COVID-19, as the importance of eosinophils in the body's immune response to viral infections is likely to be clearly demonstrated in the future research (13). It has been suggested that the dynamic changes identified in routine blood parameters and eosinophil studies may be indicators of the prognosis and treatment of COVID-19 (8). It has been claimed that there is a correlation between the increase in eosinopenia and the severity of COVID-19 disease and the increase mortality (23). In their study, Güneş et al., found that eosinophil counts were very important in the forecast made in COVID-19 cases with severe clinical features (24). In a study examining the clinical features of COVID-19 cases with severe mortality, eosinopenia was found to be a poor prognostic indicator (25). Recently, it has been stated that the number of eosinophils in the blood is a sufficient and effective indicator in the diagnosis, evaluation and prognosis of COVID-19 patients (8,26). It has been suggested that there is a correlation between the continuity of eosinopenia and the advanced severity of COVID-19 disease and the likelihood of recovery (23).

It has been suggested that the dynamic changes in the routine blood parameters can be used as indicators of the prognosis and effectiveness of treatment in COVID-19 patients (15). A decrease in eosinophil levels (eosinopenia) has been observed in SARS-CoV-2 infection (27). However, the results of some previous studies on the relationship between eosinopenia and COVID-19 disease severity were not consistent (28-29). In the study, there was no statistically significant difference in age and gender distribution between the population of survivors and those who died. 16.6% of the patients died. The mortality rate was higher in male patients, and when the eosinophil percentage dominance rates were evaluated, 81% of the lymphopenic and obvious eosinopenic patients lost their lives. Among the non- lymphopenic patients who died, the rate of obvious eosinopenia was approximately 70%.

There are some limitations to this study. The study population includes patients from a single hospital(City Hospital). It also includes only 1039 patients, which may not be sufficiently determinant for all analyses. In addition, we were unable to conduct studies in a longitudinal manner due to the availability of only single laboratory results. This study has not been published anywhere. There is no conflict of interest among the authors.

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