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Eosinophil Levels in Blood of COVID-19 Patient's VS Seasonal Allergy

Taha Luqman Bilgrami[1], Hira Saleem[2]

[1]Department of Internal Medicine, University of Debrecen, Debrecen, Hungary

[2]Department of Internal Medicine, Bahria University, Karachi, Pakistan

Email address:
tahabilgrami@hotmail.com (T. L. Bilgrami)

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Abstract: Eosinophilia, a peripheral blood with eosinophil count of more than 450 cells per microliter has been linked to allergies, medication responses, among others. However, the reduction in eosinophil levels has been particularly found to be having linkage with SARS-CoV-2 infection. This study aims at comparing COVID-19 patients' peripheral blood eosinophil levels to seasonal allergy patients' eosinophil counts to determine whether there is a link between eosinophil numbers and COVID-19 disease severity. Data was obtained from the review of the electronic medical records of 300 confirmed COVID-19 patients, alongside their clinical features were obtained. Data collected was then subjected to retrospective cohort analysis. Eosinopenia was found in 73.7 percent, 86.7 percent, and 94.3 percent of patients in the mild, moderate, and severe categories, respectively (p value 0.002). When compared to patients with moderate and severe illnesses, patients with critical disease had significantly lower eosinophil levels. Results from this study shows that increase in COVID-19 severity is associated with a significant drop in peripheral eosinophil levels, and that eosinopenia was present in the majority of COVID-19 patients. Seasonal allergic rhinitis is indicated as a particularly good model for studying the potential pathogenic effects of eosinophils and eosinophilic inflammation.

Keywords: Eosinophil Levels, COVID-19, Immunity, Allergy

1. Introduction

Coronaviruses are viruses that have an envelope around them. The envelope is connected to spike glycoproteins (S protein), envelope proteins (E protein), and membrane glycoproteins (M protein). [1] Human diseases are frequently caused by coronaviruses. Some of them primarily infect the upper respiratory tract [1, 2], causing only minor symptoms. There are three coronaviruses that usually infect the lower respiratory tract, and their infections can be lethal. SARS Coronavirus (SARS-CoV), Middle East Respiratory Syndrome Coronavirus (MERS-CoV) [3, 4], and Severe Acute Respiratory Syndrome Coronavirus 2 are the three viruses (SARS-CoV-2). [2] The reduction in eosinophil levels was a unique result related with SARS-CoV-2 infection (eosinopenia). [3] Previous research on the link between eosinopenia and illness severity, however, had mixed results. [4] while Eosinophilia, defined as a peripheral blood eosinophil count of more than 450 cells per microliter, is linked to allergies, medication responses, helminth infections, and Churg-Strauss syndrome, among other things.

Parasitic infestation and allergy inflammation have long been linked to eosinophil-rich inflammation. Eosinophils play a crucial role in asthma exacerbations, according to clinical trials. [5] The goal of this study was to look at patients' peripheral blood eosinophil levels and see if there was a link between eosinopenia and COVID-19 disease severity, as well as eosinopenia WITH SEASONAL ALLERGY [5, 6].

2. Material and Methods

2.1. Patient

We did a retrospective cohort analysis in a single center. From the commencement of the pandemic data was collected from all polymerase chain reaction (PCR) confirmed

COVID-19 cases in Houston, Texas. Between January 28 and March 25, 2021, 300 people were admitted to the research. Positive RT-qPCR results in pharyngeal swab specimens identified the conclusive cases of COVID-19 [7-9].

2.2. Data Collection

The information was gathered from the medical records of the patients. Medical histories, clinical symptoms, chest CT pictures, laboratory exams, and results were all gathered. A complete blood count, coagulation biomarkers, renal function, liver function, tissue damage, and allergy infections were among the tests performed at the lab. Leukocytes, immune granulocytes, neutrophils, lymphocytes, monocytes, eosinophils, basophils, and C-reactive protein were all counted (CRP). Lymphopenia was characterized as lymphocyte counts of less than 0.8 109 cells per liter of blood. Eosinophil levels < 0.04 109 cells/L were considered as eosinopenia [10, 11].

2.3. Inclusion and Exclusion

Patients under the age of 18, those with a history of pancytopenia, and those using systemic glucocorticosteroids were also eliminated [6]. All patients' clinical information, test findings, and various types of (oxygen) therapy were obtained through the electronic medical record system. In addition, the number of days spent ill and the length of time spent in the hospital were noted. If patients were re-admitted after being hospitalized in Houston or another hospital owing to COVID-19 after being previously discharged, re-admission was recorded [12, 13].

2.4. Data Classification

According to the severity of the disease, the patients were classified into three groups. Asymptomatic patients and those who did not require oxygen therapy were included in Group 1, commonly known as 'mild.' Patients in Group 2, sometimes known as 'moderate,' received some supplementary oxygen but not more than 15L. Patients in Group 3, also known as 'severe,' required a maximum of 15L oxygen with a non-rebreathing mask, Opti flow high-flow nasal oxygen, intubation, intensive care unit admission, or a COVID-19-related death in the hospital or after being sent to a caring home or hospice for palliative care and died within 14 days.

Table 1. *Data analysis of diseases.*

Characteristics	All (n = 190)	Disease Severity		
		Moderate (n = 69)	Severe (n = 80)	Critical (n = 41)
Numbers of patients showing the indicated symptoms				
Fever	161	59	63	39
Cough	137	42	63	32
Expectoration	55	16	30	9
Dyspnea	111	28	48	35
Hemoptysis	10	6	3	1
Fatigue	126	37	60	29
Diarrhea	38	16	14	8
Poor appetite	89	23	44	22
Numbers of patients with indicated comorbidities				
Hypertension	58	15	23	20
Cardiovascular disease	21	4	7	10
Diabetes	33	7	16	10
Chronic lung disease	10	4	2	4
Chronic bronchitis	5	3	1	1
Bronchiectasis	1	1		
Asthma	1		1	
Emphysema	1			1
Tuberculosis	1			1
Chronic Obstructive pulmonary disease (COPD)	1			1

3. Results

In our hospital, 350 patients with probable COVID-19 were seen. Patients with unconfirmed COVID-19 (n = 66) and patients who failed to complete a complete blood count (n = 101) were excluded from the study. Patients were also eliminated if they took prednisone, were under the age of 18, had a history of pancytopenia prior to COVID-19 infection, or omitted any pertinent information [14]. Non-allergic symptoms were also ruled out. A total of 300 patients were eventually included in the study (Figure 1). The demographic and baseline characteristics of the different severity groups. A total of 45 (16.5%) mild, 155 (45.7%) moderate, and 100 (37.8%) severe patients were included in the study. Patients with a more severe disease course had significantly higher leukocyte and neutrophil counts in their peripheral blood, according to complete blood counts. The number of patients with lymphopenia did not differ significantly between the groups, with 31.6 percent in the mild group, 29.5 percent in the intermediate group, and 37.9 percent in the severe group. CRP levels rose considerably with COVID-19 disease severity, as expected (p value 0.001). Between the groups, there was a considerable reduction in eosinophil levels (Figure 2, p value 0.004).

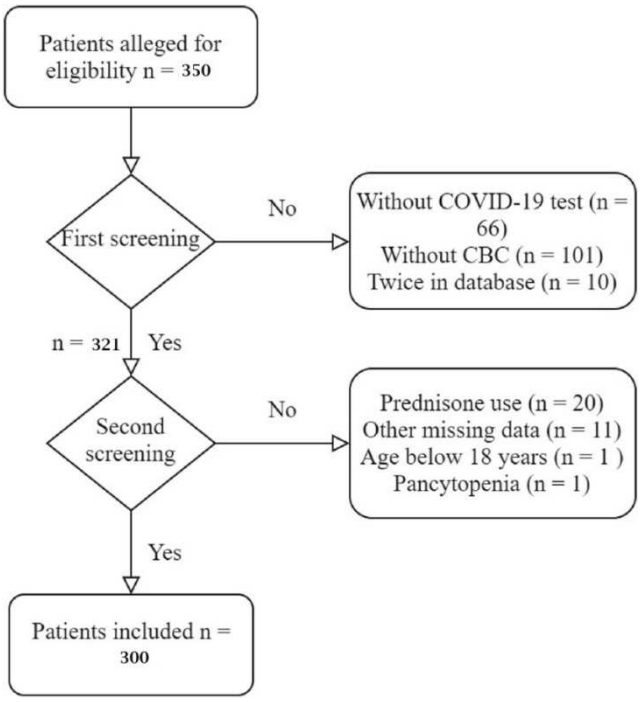

Figure 1. *A graphical framewor depicts the statistal results.*

4. Discussion

In this investigation, we found that eosinopenia was present in the majority of COVID-19 patients (87 percent). With rising COVID-19 severity, the number of patients with eosinopenia increased. Eosinopenia was found in 74 percent of patients in the low severity group, 87 percent in the moderate severity group, and even 94 percent in the most severe group (p value 0.002). These figures imply a link between eosinopenia and COVID-19 severity. While eosinophil counts and degranulation status are greatly elevated during symptom-inducing seasonal allergen exposure, nearly every eosinophil granule demonstrates symptoms of severe protein loss. During active allergic rhinitis, a combination of enhanced tissue eosinophil accumulation and widespread degranulation appears to produce significant amounts of extracellular eosinophil granule product depositions in the target tissue.

The function of eosinophils in COVID-19 is unknown. Eosinophils are leukocytes that make up a minor percentage of peripheral blood leukocytes (1–3%) in most cases [8]. Because of their prepared granules, which are filled with cytotoxic proteins, they may have pro-inflammatory effects [8]. Because eosinophils can become active during sickness, the level of eosinophils in the peripheral blood can change depending on the situation. Eosinopenia is likely multifactorial, and it could be linked to eosinophil migration into peripheral tissues, as found in other viral infections. Following acute infection with respiratory syncytial virus, for example, an influx of eosinophils into the respiratory tract has been seen [9]. Another possibility could be a reduction in eosinophil production in the bone marrow as a result of inflammation or viral attachment in the bone marrow, as in typhoid fever [10]. Patients who used exogenous glucocorticoids were excluded from this study [11]. Another possible explanation is the increased amount of endogenous glucocorticoids, which may alter peripheral eosinophil levels. COVID-19 may also cause CD8 T-cell depletion, which releases IL-5 and other cytokines [3]. Eosinophil growth and activation are aided by IL-5 [12]. Furthermore, IL-13, which can cause eosinophilia in the lungs, is heavily reliant on IL-5 [13]. If IL-5 production falls, IL-13 may become less effective. T helper 2 (TH2) cells generate both IL-5 and IL-13.

Previous biopsy studies of people with seasonal allergic rhinitis have shown that the amount of nasal tissue eosinophils can be higher even during non-seasonal conditions compared to healthy, nonatopic persons 24. The current investigation confirms the presence of a mild baseline eosinophilia and shows that these eosinophils are frequently of the degranulating form (the degranulation was less pronounced than in symptomatic patients during the season). However, when compared to a correct baseline, such as circulating blood eosinophils, multiple facts show that the off-season eosinophil properties indeed represent real degranulation.

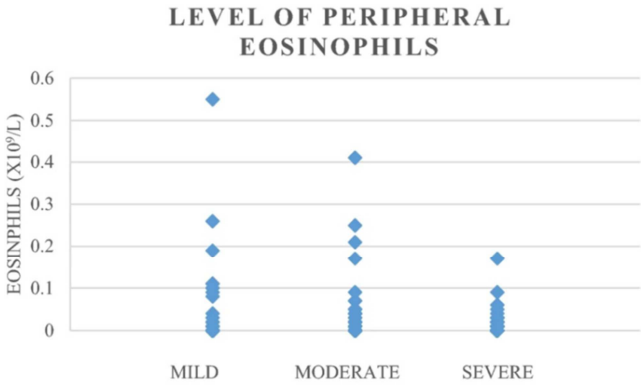

Figure 2. *Level of peripheral Eosinophiles.*

5. Limitations

One of the study's drawbacks is that we only know the number of disease days at the time of blood collection, not the number of days between a positive COVID-19 test and blood collection. Another potential drawback of this study is its retrospective character; nonetheless, the inclusion of 300 PCR-confirmed COVID-19 patients and the fresh data on peripheral eosinophil levels in these patients are important in learning more about COVID-19. Only a few research have looked into the role of eosinophils in COVID-19.

6. Conclusion

Finally, eosinopenia is found in the majority of COVID-19 patients and appears to be related to disease severity in our research. Finally, seasonal allergic rhinitis is indicated as a particularly good model for studying the potential pathogenic effects of eosinophils and eosinophilic inflammation.

Conflict of Interest

The authors declare that research has no conflict of interest.

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