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IP Journal of Diagnostic Pathology and Oncology

Journal homepage: https://www.jdpo.org/

Original Research Article

Importance of absolute eosinophil count in covid-19 patients

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ARTICLE INFO

Article history:
Received 30-07-2022
Accepted 10-08-2022
Available online 22-09-2022

Keywords:
COVID 19
Eosinopenia
Absolute eosinophil count
Mortality

ABSTRACT

Introduction: Coronavirus 2 (SARS-CoV-2) has created worldwide healthcare problems and strained health resources. Reduced eosinophil levels are one of the unique discoveries that have been discovered in COVID 19 recently. The goal of this study is to establish the association between the mortality in COVID-19 with eosinopenia by retrospectively analysing data from fifty COVID-19 patients with varying illness severity, including moderate, severe, and critically ill.

Materials and Methods: Fifty patients taken from Sree Balaji Medical College and Hospital, of which twenty five critically ill patients and twenty-five having moderate to severe COVID-19 infection at hospital admission were enrolled. After being admitted to the hospital, information on the patient's medical history, clinical symptoms, CT severity score, and outcomes were taken from their medical records.

Results: The study concluded that Compared to individuals with moderate and severe disorders, critical illness patients' eosinophil levels were much lower. Eosinophil levels gradually decreasing was found to be a separate factor which has been associated with mortality.

Conclusions: Patients with COVID-19 who have eosinopenia have a considerably higher mortality rate. These values can be obtained by simple means such as obtaining peripheral blood, so this is an easy and an effective indicator in monitoring these patients.

1. Introduction

The severity of COVID-19 infection spans a wide range, from asymptomatic to severe acute respiratory syndrome requiring mechanical ventilation. SARS-CoV-2 is the pathogen responsible for the coronavirus disease 2019. Majority of patients presented with milder symptoms while few deteriorated into a critical state. Since the underlying pathophysiology still remains unclear it is necessary for us to identify various parameters that can help us in determining the prognosis of the patient. One such prognostic parameter is absolute eosinophil count.

2. Materials and Methods

This was a retrospective study which included 50 covid positive patients treated at Sree Balaji Medical College and Hospital, Chennai from April 23, 2021 to May 23, 2021.

2.1. Data collection

The following data were collected from Covid Ward and Covid Intensive Care Unit of Sree Balaji Medical College and Hospital. Clinical data including their Age, Gender, Comorbidities, Clinical Symptoms. Laboratory investigations including total leukocyte count mainly the absolute Eosinophil Count.

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https://doi.org/10.18231/j.jdpo.2022.041

2.2. Patient and public involvement

Since this was a retrospective case series study, and no patient was included in the study design.

3. Results

A total of 50 patients were taken of which 25 were critically ill and 25 patients with moderate to severe illness. Patients were divided into four categories, according to the Guidelines for the Diagnosis and Treatment of COVID-19 (5th edition): mild, moderate, severe, and critically ill.

Mild patients were defined as those who had little to no clinical symptoms, upper respiratory symptoms, either with or without fever, and no signs of hypoxia or shortness of breath. Moderate patients were considered those with fever and with respiratory tract symptoms, respiratory rate >24/min and Saturation of oxygen <94% at room air and Image findings showing pneumonia. The patients under the category of severe were considered with respiratory distress and respiratory rate ≥ 30 beats/min with oxygen saturation ≤ 90% at room air. Patients requiring mechanical ventilation and those considered as critically ill.

Table 1: Showing characteristics of the enrolled patients – age distribution and gender

Age Group			
Age	**Moderate – severe patients**	**Critically ill patients**	**Total**
<40	4	2	6
40-50	9	2	11
50-60	4	6	10
60-70	6	11	17
>70	2	4	6
Total	25	25	50
Gender			
Male	15	14	29
Female	10	11	21

A total of 50 cases were taken of which 25 moderate to severe cases and 25 critically ill patients. Most of the cases of moderate to severe cases were between the age 40-50 years and most of the critically ill patients were between the age group of 60-70 years showing the disease severity is higher as the age increases.Table 1

Of the 50 patients, 29 were male and 21 were female showing a higher occurrence in males with an odds ratio of 1.17. Several studies have also shown that male sex and people with co-morbid risk factors have higher risk of development of COVID. [1,2]

Out of the 25 patient in the category of moderate to severe cases most of the patients presented with fever, myalgia, tiredness and cough. And the most common presentation of critically ill patients were dyspnoea.Table 2

Y-Axis determines the value of absolute eosinophil count

Table 2: Showing the symptoms of the moderate to severe patients and critically ill patients

Symptoms	**All (50)**	**Moderate to severe patients (25)**	**Critically Ill (25)**
Fever	31	15	16
Cough	25	11	14
Expectoration	14	8	6
Dyspnoea	23	5	18
Myalgia	21	12	9
Anosmia	7	3	4
Loss of Taste	8	4	4
Tiredness	18	12	6
Sore throat	7	4	3
Headache	3	2	1
Loose stools	4	2	2
Chest pain	2		2
Vomiting	2	2	

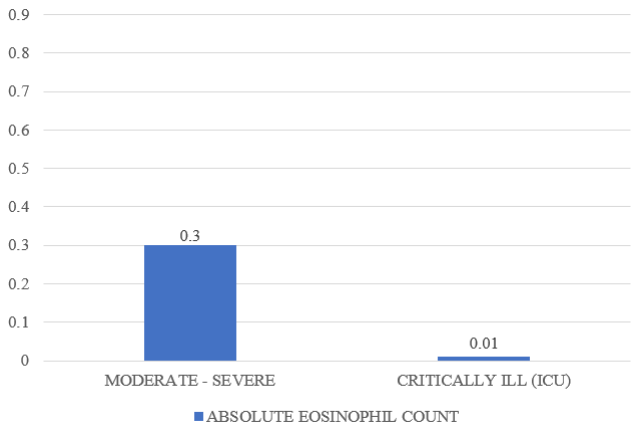

Fig. 1: Comparison of Absolute eosinophil count between Moderate to severe cases and critically ill patients

Normal: 0.5 X 10^9/L

Absolute Eosinophil Count is calculated by multiplying the total count of WBC with the number of circulating eosinophil counted.

Normal range of eosinophils is 0.5 X 10^9/L or 50-500 cells per microliter.Figure 1

Mean value of absolute eosinophil count was 0.2 X 10^9/L and the mean value of absolute eosinophil count was 0.00 X 10^9/L.

Our study conducted shows that the value of absolute eosinophil count is significantly lower in critically ill patient than those compared with patients having moderate to severe diseases.

4. Discussion

Eosinophils are potent proinflammatory cells have prepared granules that are jam-packed with cytotoxic substances. Eosinophil peroxidase, eosinophil cationic protein, and

eosin eosinophil neurotoxin which are called as the three major basic proteins.[3] These function as Immune regulatory function directed against parasitic, bacterial and viral infection. Several endosomal Toll-like receptors (TLRs), including TLR3, TLR7, and TLR9, are expressed by human eosinophils and are responsible for detecting viral and microbe-associated molecular patterns.[4,5] Among these three TLR7 is mainly responsible for the cytokine release and they are capable of formation of superoxide and nitric oxide with prolonged survival of the cells.[6] They are also powerful detectors of single stranded RNA virus such as the corona virus.[7] Additionally, TH1 cytokines like IL-12 and IFN that are necessary for the development of efficient antiviral immune responses may be quickly recruited by eosinophils.[8,9]

Eosinophils have a number of well-known functions, including their association to asthma and parasitic infection. These conditions result in an increase in blood eosinophil counts. Eosinophils usually fight against parasite infections, but they may also be harmful in cases of severe asthma, according to earlier research. According to recently revealed evidence from animal research, eosinophils has also bound to have antiviral property.[10,11] Eosinopenia can be due to a single factor or a combination of mechanisms, such as reduced eosinophil production, increased destruction in vascular sequestration or due to increased migration to the tissues. Cytokine storm is of the key feature in COVID and during this there is modification of the tissue resident eosinophils leading to increases margination.

The eosinophil's ability to fight viruses may be influenced by two biological processes: Initially, viruses stimulate eosinophils, which then produce chemicals such as the cationic proteins and neurotoxin which are capable of potentially inactivating the viruses.[12,13] Furthermore, they consists of molecules which can stimulate molecules such as the toll like receptors, MHC 1 and II, along with CD 80 and CD86.

Individuals with associated other associated co-morbidities are more likely to have higher risk for COVID because of the inflammation processes associated with it.[14] So this aroused queries about the relative threat that people with asthma which is actually a chronic inflammatory condition[15] Given the prior research indicating that eosinophils play a part in the host's defence against respiratory viral infection[16] Ferastroanu et al.[17] in his study showed that asthma patients who had a high eosinophil count at their initial visit were less likely to be hospitalised with COVID-19 and, if they were, they were also less likely to suffer from a serious illness.

Eosinophils at less than 5 per microliter have been one of the criteria in Ma et al.[18] risk stratification score, COVID-19-REAL, which was used mainly to identify patients who can either present with the disease or those who are more prone to develop into severe cases. In a related research, Tordjman et al[19] created the PARIS score, which used eosinophil levels below 60 per microliter to predict the likelihood of a SARS-CoV-2 diagnosis. In a study conducted by Du et al.[20] 81% of the patients had AEC level that were below the normal range at the time of admission.

When the patient eosinophil count was recorded, it was found to increase progressively as the patient recovered. A similar study conducted by Chen et al[16] showed that the eosinophil count was found low in the entire course of the disease which in most instances led to fatal outcomes. His study also showed that the counts increased in patients who had recovered returning to almost normal levels.

5. Conclusion

The study concluded that the level of eosinophil is much lower in patients with critical illness than those with moderate to severe diseases. The patients who had lesser eosinophil level were likely to easily succumb to the disease with longer hospital stay. Since many protocols are emerging for COVID 19, monitoring of the eosinophil levels can be recommended for monitoring the progression of the disease through simple method such as peripheral blood smear.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Cite this article: Gaur K, Natarajan S, Sarika K, Gupta M. Importance of absolute eosinophil count in covid-19 patients. *IP J Diagn Pathol Oncol* 2022;7(3):174-177.