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EOSINOPENIA IN CRITICALLY ILL COVID-19 PATIENTS: AN INDIAN MONOCENTER RETROSPECTIVE STUDY

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ABSTRACT

Introduction: The coronavirus disease 2019 (COVID-19) pandemic is a serious public health concern worldwide. The virus mainly causes respiratory symptoms and other manifestation. Assessments showed that COVID-19 can cause various alterations in the blood parameters especially in eosinophil counts. **Objectives:** Our study aims to assess the diagnostic role of eosinophils count in severe acute respiratory syndrome coronavirus-2 infection at the time of hospital admission. To determine the relationship between eosinopenia and COVID-19 mortality as well as the clinical conditions that could potentially lead to mortality. **Patients and Methods:** A retrospective study was carried out during the period of March 2020 to March 2021 in Saveetha Medical College and Hospital, Tamil Nadu, India. Total of 350 patients with COVID-19 infection were taken for this study. Demographic data was collected from patients medical records at the time of hospital admission included medical histories, clinical symptoms, Radiological findings. Eosinophil counts was obtained from Sysmex Automated Analyzer NX1000. **Results:** In our study, on gender distribution out off 350 patients, 207 cases were males, 143 were female. 72 patients were admitted in critical ward and 278 were admitted non critical ward. In which eosinopenia was observed in patients admitted in critical ward and normal eosinophil counts was observed in patients admitted in non critical ward. **Conclusion:** Eosinopenia is an early indicator of COVID-19 infection if progressively

worsening may progress to critical disease and have a significantly higher chance of mortality.

KEYWORDS: COVID-19, eosinophil count, Absolute eosinophil count, eosinopenia and hematological parameters.

INTRODUCTION

The corona virus disease 2019 is caused by the virus SARS-CoV-2 and is declared as a global pandemic by World Health Organization. It was first recognized in Wuhan, China, in December 2019. Genetic sequencing of the virus suggests that it is a beta coronavirus closely linked to the SARS virus.[1] The exact mode of transmission of the disease is not known, and while the current information is limited, it supports person-to-person transmission.[2,3] The most possible routes of transmission are thought to be droplet-based and contact-based . Patients mainly an upper respiratory tract infection in over more than 90% cases more likely to have more severe condition and death, usually in older adults and people with certain pre-existing medical conditions. Some common clinical manifestations in patients suffering critical COVID-19 disease includes pneumonia, respiratory failure, acute respiratory distress syndrome (ARDS), venous thrombosis, lung thromboembolism, pulmonary fibrosis, septic shock, systemic inflammatory response, renal damage, cardiovascular damage, blood-vessel damage, and multiple organ failure.[1,3] Early detection of patients prevent development of critical illness and optimize the use of hospital resources. COVID‑19 disease are closely associated with haematological parameter especially in eosinophil counts and have an important role in early diagnosis of the disease, considering the information they provide to clinicians regarding the inflammatory process.[14] Obtaining eosinophil count is cost-effective, convenient, and fast predictive marker for patients with COVID-19 is highly demanded during this pandemic period. Eosinophils are multifunctional cells involved in mainly in inflammatory response triggered by diverse stimuli. It is already known that bacterial infection would result in eosinopenia condition.[5,6] Multi analytical studies have found that eosinopenia critically ill patients, could be a useful biomarker But, there is no evidence showing that eosinopenia and COVID-19 associated with. Therefore present study, aims to evaluate the value of eosinophil count as a predictive marker for COVID-19 patients.

Inclusion criteria

Includes all age group of patients diagnosed with COVID-19 by detecting SARS-CoV-2 RNA in oro-nasopharyngeal swab samples and Radiological images findings.

Exclusion criteria

Patients with clinical features of COVID-19 but RT- PCR negative and patients with leukemia.

PATIENTS AND METHODS

A retrospective study was carried out in line with research regulations, including the approval of the Ethical Committee. Total of 350 patients with COVID-19 infection were taken for this study during the period of March 2020 to March 2021 in Saveetha Medical College and Hospital, Tamil Nadu, India. The diagnosis was confirmed detecting SARS-CoV-2 RNA in oro-nasopharyngeal swab samples and Radiological images findings. Demographic data was obtained from the patients medical records and estimation of haematological parameters (eosinophil count) was done by Sysmex Automated Haematology Analyser XN-1000 from the department of Haematology, obtained during the time of admission.

Statistical analysis

The SPSS, version 19 software was used for the processing data. All the values were expressed as mean±standard deviation unless otherwise indicated. The differences in the mean values between the groups were analyzed by using the Student's t-test. A p-value of <0.05was considered statistically significant. The study was approved by the Saveetha institutional ethical committee.

RESULTS

In our study, on gender distribution out off 350 patients, 207 cases were males, 143 were female (Fig 1). 72 patients were admitted in critical ward and 278 were admitted non critical ward. In which eosinopenia was observed in patients admitted in critical ward and normal eosinophil counts was observed in patients admitted in non critical ward. (Table 1) The Mean value of eosinophil count in critical care patients was 0.013 ± 0.04 and 0.353 ± 0.16 in non-critical patients (Fig 2a). On comparison between them showed p-value significant (less than 0.001). The Mean value of Absolute eosinophil count in critical care patients was 46 ± 72 and 126 ± 219 in non- critical patients (Fig 2b). On comparison between them showed p-value significant (0.001).

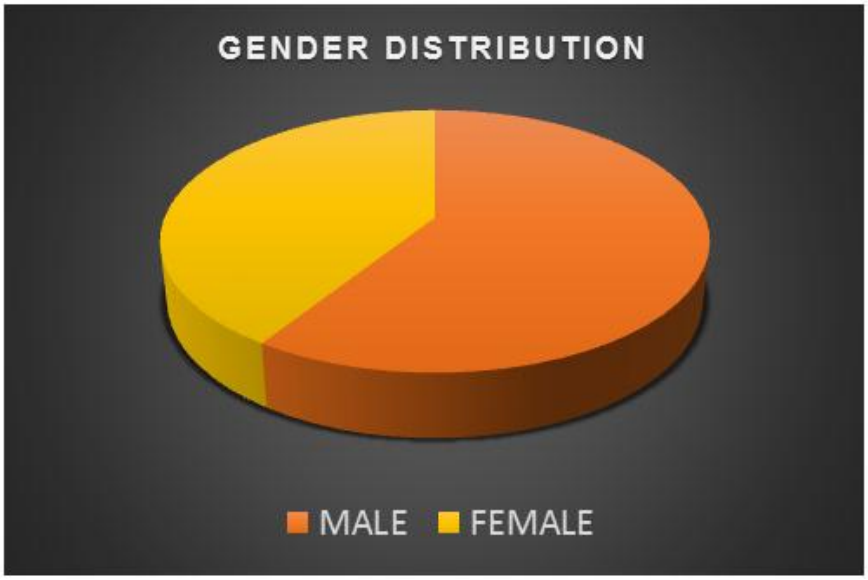

Figure 1

Table 1

Parameters	Patients admitted in critical care (n = 72)	Patients admitted in non critical care (n = 278)	P value
Eosinophil count	0.013 ± 0.04	0.353 ± 0.16	0.001
Absolute eosinophil count	46 ± 72	126 ± 219	0.001

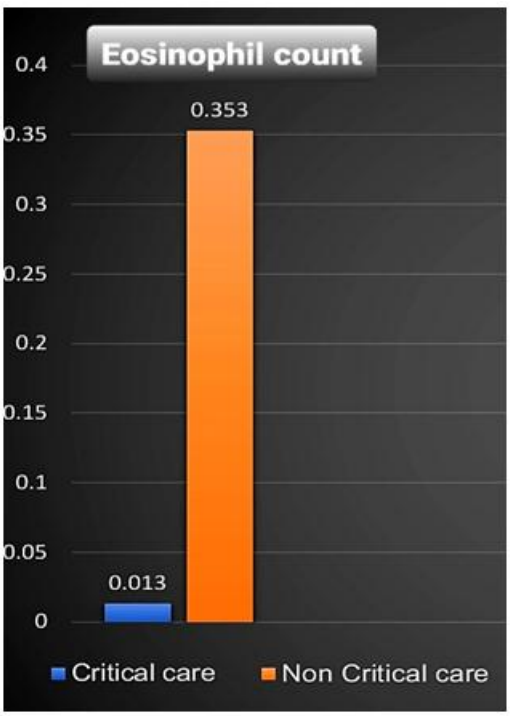

Figure 2a

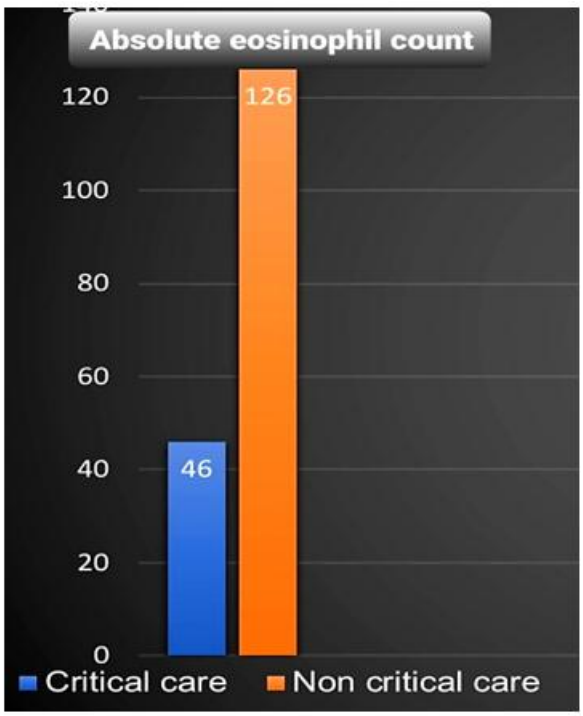

Figure 2b

DISCUSSION

Eosinophils are circulating and tissue-resident leukocyte cells, which contribute proinflammatory, immunoregulatory and antiviral effects. Eosinopenia has been previously reported in various medical conditions such as bacterial infections, acute inflammatory conditions and corticosteroid therapy.[4,5] Our research began from the fact that a patient was clinically diagnosed with COVID-19 but with a false negative RT-PCR test. So, we aimed to determine eosinopenia was a useful complementary tool to diagnose COVID-19. Our studies demonstrated that a progressive decline of eosinophil levels was associated with mortality among critical ill COVID-19 patients. In addition, our analysis revealed a significantly positive (p value less than 0.05) correlation of eosinophil counts and absolute eosinophil count between critical and non- critical COVID-19 patients. These finding can be potentially important because eosinopenia was associated with the organ failure and tissue damage especially in lungs.[6] The pathophysiology for eosinopenia in COVID-19 could be multifactorial, involving the migration of these cells into the peripheral tissues or to a decreased production of eosinophils into the bone marrow, due to the inflammatory state, inhibition of eosinophilopoiesis, reduced eosinophil-driving cytokines or direct interferon-induced apoptotic activity.[10,12] Studies suggest that, eosinophil exhaustion was associated with neutralization of virus with eosinophil-derived enzymes, but from another perspective, eosinophil may be just a coincidence when IL-33 pathway was affected during an viral infection.IL-33 is responsible for eosinophil activation locally in the airways and at the bone marrow level and ciliated epithelial cells, are the first target of corona virus, due to IL-33-positive epithelial cells. IL-33 is important for the activation of group 2 innate lymphoid cells because it produces IL-5 and IL-13.[8] IL-5 is responsible for eosinophil recruitment to the airways and IL-13 is required for mucous hypersecretion.[5] Eosinophils count can be significantly influenced by the endogenous secretion of glucocorticoids, and increased cortisol levels observed during COVID-19 may also leads to eosinopenia. Activation of the FAS pathways can also induce eosinophil apoptosis , which was enhanced by the presence of the Th-1 cytokines, such as IFN-γ and tumor necrosis factor-α.[14,15] Eosinophils express molecules such as toll-like receptors, CD80, CD86, and major histocompatibility complex I and II molecules that are sufficient for stimulating an immune response.[13] Example, influenza virus-infected eosinophils can act as antigen presenting cells and stimulate the virus-specific CD8 T cell-mediated antiviral immune response.[6,9] This mechanism is important because, if eosinophils play a major role in the immune defence against SARS-CoV-2, strategies to correct the eosinopenia in COVID-19 patients.[16] Other studies have also

speculated that the improvement of eosinopenia may be an indicator of COVID-19 patients improvement, but more data will be needed to confirm the hypothesis. here are limitations in our study, may be our small sample size and a monocenter study. Further studies are necessary to investigate the pathogenesis between eosinopenia and COVID-19.

CONCLUSION

Our study concludes, persistence of eosinopenia delays the recovery in COVID-19 patients. Hence, eosinophil count is a useful biomarker and fast compared with other expensive time-consuming CRP test and D- dimer test. Also helps to assess to severity by distinguish between critical and non critical COVID-19 cases. But a multicenter study with a larger cohort study is required for further validation for the present study.

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Statement of ethics

This study was approved by Ethics Committee of Saveetha Medical and Hospital. As this study was a retrospective study, there was no patient's privacy data such as patient name, ID number, telephone and address were involved. Only demographic information and laboratory testing data of patients were collected and analyzed in this study.

Disclosure statement: All authors declared no conflicts of interest.

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