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RESEARCH ARTICLE

A BREIF STUDY OF HAEMATOLOGICAL PARAMETERS IN COVID 19

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Abstract

Objectives: Ever since the World Health Organization announced COVID 19 infection a pandemic, continuous spread of the virus has affected all over the world. An understanding of the pathophysiology of this disease is necessary for its effective treatment. Laboratory investigations play an important role in the diagnosis as well as management of this infectious disease. Hematological parameters demonstrate alterations during the progression of COVID- 19 infection. Some are indicative of extremely poor clinical outcome. Hematological findings like leukopenia, lymphocytopenia, thrombocytopenia and coagulation- related abnormalities are the most common manifestations. The aim of this study was to assess the pattern of alteration in hematological parameters with emphasis on total leukocyte count, absolute lymphocyte count and platelet count in COVID 19 positive patients.

Material and methods: Patients suffering from COVID- 19 were categorized into two groups: Group I and Group II on the basis of severity of disease. Various hematological parameters of these patients such as neutrophil counts and white blood cell counts, d- dimer levels, hemoglobin levels, fibrinogen and platelet counts were assessed.

Results: Normal white blood cell and increased neutrophil count among COVID- 19 infected patients were seen. However, median values in Group II ($P < 0.01$) were found to show significantly higher values when compared to Group I. A significant ($P < 0.01$) decrease in lymphocytic counts and hemoglobin level were found among Group II patients. Platelet counts were in normal range in all COVID- 19 patients. Routine coagulation tests revealed increased fibrinogen ($P < 0.01$) and d- dimer levels ($P < 0.0001$) in severe and critical patients.

Conclusion: Analysis of hematological parameters in COVID- 19 patients may help in deciphering the clinical progression of patients suffering from COVID- 19 disease. Thus, regular monitoring of the hospitalized patients may help in planning better management of these cases.

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Introduction:-

Coronavirus disease 2019 was first reported in Wuhan city, Hubei, China, in December 2019¹. The disease is mainly transmitted through respiratory and body contact². Patients with coronavirus disease presented with a series of clinical symptoms, including raised body temperature, cough, headache, nausea, vomiting, anorexia, diarrhea, dyspnea, multiple organ dysfunctions³. Some patients progressively develop serious complications, including sepsis, acute respiratory failure, metabolic acidosis, heart failure, kidney injury, hypoxic encephalopathy, and eventually die of the illness³. A large proportion of infected patients reported mild symptoms of the disease and recover⁴. Few patients also reported anosmia and ageusia⁵. Considering high transmission and infectivity patterns, World Health Organization announces it as an emergency of public health concern on March 31, 2020⁶. The first case of COVID-19 in India was reported on 30 January 2020 in Kerala.

Literature on laboratory-confirmed coronavirus cases showed changes in the hematological parameters such as lymphocyte count, neutrophil count, and D-dimer status of patients^{4,7}.

Few study have reported alternation in inflammatory markers in patients with COVID-19, including C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and Interleukin-6³. Tian et. al reported lymphocytopenia, high blood sugar, gamma-glutamyl transferase (GGT), high lactate dehydrogenase (LDH) in COVID-19 affected patients⁸.

It has been seen that individuals with blood group A demonstrated a higher risk of COVID-19 infection than group O subjects⁹. Blood tests such as lymphocyte count, CRP levels play an important role in the early diagnosis as they can provide useful information regarding the process of inflammation within the body and organ damage such as acute renal failure and hepatic involvement⁹.

There is an urgent requirement for an early identification of effective diagnostic and prognostic biomarker of disease progression towards clinical decline, and eventually patient mortality. Lymphocytopenia is a prominently consistent feature in the affected subjects. This virus shows affinity towards the ACE- 2 receptors located on lymphocytes and is attributable for its cytopathic effects¹⁰.

It has been hypothesized that lymphocytopenia is due to direct viral infection of lymphocytes, destruction of lymphocytic organs and apoptosis of lymphocytes. Worsening of lymphopenia is seen in severely infected patients^{11,12}.

Chest radiography shows features of consolidation and ground- glass opacifications. Tian et al.¹³, reported radiological changes in chest finding including injury to the alveolar epithelial cells, formation of hyaline membrane and type II pneumocytic hyperplasia. There is an extensive proliferation of fibroblasts which appear as consolidation radiographically.

The aim of the study was to retrospectively analyze the dynamic profile and clinical implications of various hematological parameters in patients diagnosed with COVID- 19.

Materials and Methods:-

The study was done on 207 hospitalized patients infected with COVID-19 at a tertiary care hospital of Eastern India. The study was approved by the Institutional Ethics Committee. The need for written consent was deferred considering the research design.

Inclusion criteria

A confirmed case of Covid-19 defined by positive result on a reverse transcriptase– polymerase-chain-reaction (RT-PCR) assay of a specimen collected on a nasopharyngeal swab¹⁴ were included in the study.

On the basis of clinical state of the infected patients at the time of hospital admission, they were classified into:

- (a) Regular COVID- 19 group (Group I): This group consisted of patients suffering from pyrexia, respiratory symptoms and radiographic features of pneumonia.
- (b) Severe COVID- 19 group (Group II): This group of patients presented with clinical symptoms such as (i) shortness of breath; (ii) greater than 30 breaths per minute of respiratory rate; (iii) peripheral blood oxygen

saturation lesser than 93% at rest; (iv) pulmonary radiographic imaging indicative of disease progression greater than 50% within 24- 48 hours.

For this study, details such as patient's age, gender, clinical symptoms, systemic complications, and hematological parameters were recorded and reviewed.

Statistical Analysis

All results were expressed in Mean±S.D. Data were analyzed using SPSS, version 24. Mean and standard deviations were used for the comparison of continuous variables ensuring normal distribution. Median and interquartile range (IQR) was used to present the findings. An Independent student's t-test was used to compare the means of variables. p value < 0.05 was considered significant.

Result:-

A total of 200 patients were included in the study. The median age was found to be 49 years. The chief clinical manifestations were found to be cough, fever and fatigue in COVID- 19 patients Group I, while shortness of breath was observed in Group II, severe and critically ill subjects.

The laboratory results demonstrated normal white blood cell (WBC) and platelet counts in patients of COVID- 19. Neutrophil counts were significantly higher in severe sick group (group II) compared to the first group (P < 0.01).

Decreased lymphocyte counts were found in most of the patients suffering from COVID- 19 and were found to be much lesser in severe ill patients (P < 0.01). The hemoglobin levels were found to show a decrease which was found to be more so among the severe sick patients (P < 0.01) suffering from COVID- 19. Routine tests for coagulation demonstrated increased D- dimer levels in patients suffering from COVID- 19. This was found to be more in the severe ill patients (P < 0.01).

Table No. 1:- Comparison of hematological parameters among patients with COVID-19 (N = 200).

Parameters	Group I (Regular COVID-19) (n=120)	Group II (Severe COVID-19) (n=80)	P value
White blood cell count, ×10 ⁹ /L	7.2 ± 3.5	8.6 ± 6.3	P>0.05
Neutrophils count, ×10 ⁹ /L	6.5 ± 1.5	8.1 ± 1.3	P<0.001
Lymphocytes count, ×10 ⁹ /L	2.3.±1.5	1.4 ± 1.7	P<0.001
Platelet count, x10 ⁹ /L	193.07 ± 83.53	168.58 ± 112.54	P>0.05
Hemoglobin, g/L	10.66 ± 2.17	9.49 ± 2.43	P<0.001
D-dimer, ng/mL	624.00 ± 728.04	824.43 ± 396.24	P<0.001

P < 0.001 - Highly significant. P > 0.05 - Not significant.

Discussion:-

There are variations in the clinical symptoms and hematological profile of patients diagnosed with COVID- 19. Acute illness related to COVID- 19 may be defined as 'clinical features such as dyspnea or hypoxia which require in hospital admission'¹⁵.

In this study, the white blood cell and neutrophilic counts were statistically higher in patients with severe clinical presentations or Group II.

Margekar et al¹⁶, reported that the neutrophil to lymphocyte ratio may act as a biomarker for the assessment of the disease severity in COVID- 19 infection, especially among the pediatric patients.

Usul E et al¹⁷ found a significant increase in WBC count, neutrophil to lymphocyte ratio, D- dimer levels, ferritin levels and LDH levels.

Dawood et al¹⁸, in their study showed that 9.82% of patients had leukocytosis, 5.4% had leucopenia, 5.36% had lymphopenia while 14.28% patients had neutrophilia. Among the coagulation disorders, 6.25% suffered from thrombocytosis whereas 5.36% had thrombocytopenia.

Henry et al¹⁹, reported significant alterations in hematological, biochemical, coagulation and immune biomarkers such as increase in neutrophil and WBC count, reduction in platelets and eosinophil counts, reduction in hemoglobin and albumin levels in COVID- 19 positive patients.

Yuan et al.²⁰, demonstrated statistically significant lower counts of lymphocytes, decreased red blood cells, hemoglobin levels, levels of immunoglobulins ($P < 0.01$), fibrinogen, WBC count, neutrophil counts, C- reactive protein, procalcitonin, erythrocyte sedimentation rate, IL- 6, ferritin and LDH in COVID- 19 positive patients.

Liao et al.²¹ reported significantly lesser lymphocytic and eosinophilic counts in individuals with critical disease than compared to severe or moderate COVID- 19 infection. A high thrombocytopenic disease when compared to those with moderate disease ($P < 0.0001$) was also noted.

The novel scope of this research included investigation of various laboratory parameters that were associated with the severity and mortality of COVID- 19 infection. These simple parameters included, WBC count, lymphocytes, platelet count and D- dimer. These were screened and evaluated in patients during the progression of this pandemic.

Careful evaluation of these laboratory parameters at time of admission and during the course of disease can assist physicians in formulating an effective treatment approach and care to COVID 19 patients.

Conclusion:-

Study of different laboratory parameters has been associated with severity and mortality in COVID- 19 infection. Our study has distinctly studied various hematological parameters in mild to severe cases of COVID- 19 infection. Thus, emphasizing the usefulness of these parameters in predicting disease progression. This may be of great help to clinicians, who may consider the hematological parameters in the patients with COVID-19, for future decision-making and planning further management.

Conflict of Interest:

None

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Self

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