Study of Hematological Parameters in Covid-19 Patients

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Abstract
Background:SARS-CoV-2, the causative agent of coronavirus disease 19 (COVID-19), was identified in Wuhan, China Since its first description, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), formerly known as 2019-nCoV, has attracted tremendous attention in a short period of time as the death toll and number of confirmed cases grows unceasingly. Routine examinations include complete blood count, coagulation profile, and serum biochemical test. Complete blood count is the most available, efficient and economic examination.
Materials and methods: This is a retrospective study done in department of pathology. Peripheral blood parameters, neutrophil lymphocyte ratio (NLR) and platelet count were studied in patients with confirmed COVID-19 infection .
Results: Out of 500 cases included in this study, 310(62%) were males and 190(38%) were females. lymphopenia is a predominant finding seen in 63% of the cases , neutrophilia seen in 61% of the cases, 39% of them showed leucocytosis while leucopenia was seen in 3% cases . Thrombocytopenia was observed in 19% of cases. An increased Neutophil /lymphocyte ratio(NLR) was seen in 60% of the cases.
Conclusion: Leukocyte count, neutrophil count, platelet count and NLR values are valuable hematological parameters in COVID-19 infection.
Keywords: COVID-19, complete blood count, Neutrophil/ lymphocyte ratio, platelet count.

I. Introduction

On 29 December 2019, pneumonia cases were detected in a hospital in Wuhan, China(1). With rapid spreading of the outbreak, the WHO announced a public health emergency of international concern (2). Thus, the COVID-19 infection has led to a pandemic that has affected millions worldwide .SARS-CoV-2, formerly known as 2019-nCoV, is a newly emerging virus belonging to the Coronaviridae family, presumably derived from a bat SARS-like coronavirus and transmitted to humans after the emergence of mutations in the spike glycoprotein (protein S) and nucleocapsid N protein (3).COVID-19 is a mysterious respiratory and systemic syndrome primarily presenting with clinical symptoms like fever, tiredness, dry cough, diarrhea, loss of smell or taste, chest pain and shortness of breath , while in some cases (8–15%) depending on the geographical setting and individual characteristics lead to a critical condition necessitating specialized management at intensive care units (ICU) (4). Severe respiratory disease can be seen in the elderly and specific patient groups, such as those with underlying medical conditions[5].

Recently, it has been reported that haematological parameters and inflammatory indexes based on blood cell analysis had an important predictive value for the prognosis of infections, and many other diseases [6-8].Blood tests have an important role in early diagnosis of the disease, considering the information they provide to physicians regarding the inflammatory process. This information includes leukocyte count and characteristics such as neutrophil- or lymphocyte-dominance, inflammation (CRP), collateral organ damage and the severity of the disease. Furthermore, biomarkers provide information regarding the nature of pneumonia, meaning that physicians can determine whether a disease is bacterial or due to other etiologies by analyzing blood test results (9)

Complete blood counts (CBC) are easily performed , available , efficient and inexpensive. CBC comprises of values such as white blood count, neutrophil, lymphocyte and platelet count (PLT), and certain ratios of these values. Neutrophils are the most characteristic cell type among the white blood cells and are an important component of the immune system. Regulated by mast cells epithelial cells and macrophages, neutrophils also take part in inflammatory processes. The role of lymphocytes in both inflammation and infections is evident. Additionally, thrombocytes also have importance in the regulation of various inflammatory processes. While these parameters may be used as inflammatory markers by themselves, their ratios to one another may also be indicators of early inflammation [10-12]. Circulating leukocytes respond to stress by

increasing neutrophils and reducing lymphocytes; the ratio of these two parameters is also used as an inflammatory marker [13].

This study is aimed to use haematological parameters (e.g. neutrophils, lymphocytes and platelets) and blood cell count indexes, particularly NLR in COVID-19 patients.

II.   Materials And Methods

This is a retrospective study carried out in the Department of Pathology, Dr Shankarrao Chavan Government Medical College , Vishnupuri, Nanded. A total of 500 cases were studied who were confirmed COVID-19 positive patients hospitalised in our tertiary care centre from 15 September to 30 November 2020. The diagnosis was confirmed by detecting SARS-CoV-2 RNA in swab samples by real-time PCR (RT-PCR) or Rapid Antigen Test. Only the results of CBC tests was used from these patients. The blood sample was collected in the covid isolation wards and was studied in the Central Clinical laboratory by us using the Nihon Kohden 5 Part Fully Automated Hematology Analyzer MEK-6410P/MEK-6420P.

III.   Results:

Of the 500 patients included in the study, 62% were male and 38% were female(table no.1) .CBC parameters were obtained from these patients and studied. As seen in table no 2, lymphopenia is a predominant finding seen in almost 63% of the cases followed by neutrophilia seen in 61% of the cases. Although the total leucocyte count varies among the patients, which may reflect either lymphopenia or neutrophilia , 39% of them shows leucocytosis while in 3% of cases leucopenia was noted. Thrombocytopenia which is an important indicator of severe disease in COVID-19 patients was seen in 19% of cases. Another potential application of data derived from the CBC would be to use formula such as neutrophil-to-lymphocyte ratio (NLR)) to assess the extent of systemic inflammation. An increased Neutophil /lymphocyte ratio was seen in 60% of the cases .

Table 1: Distribution of covid-19 positive patients according to gender

Gender	No of patients	Percentage
Male	310	62%
Female	190	38%

Table 2: Hematological parameters in covid-19 positive patients (total no of cases -500)

Laboratory findings	Number of cases	Percentage
Leucocytosis	195	39%
Leucopenia	15	3%
Lymphopenia	315	63%
Neutrophilia	305	61%
Thrombocytopenia	95	19%
Increased Neutrophil/lymphocyte ratio	300	60%

IV.   Discussion:

Data from few published articles reflecting the value of blood cell count and differential percentages of lymphocytes and neutrophils from patients with severe/non-severe COVID-19 is compared. In our study, lymphopenia was a prominent finding in most patients (63%) .Lymphopenia is the most common finding in other studies done by Liu et al(15) , Wu et al(16), Huang et al (14)and Xu et al (17)which is seen as 55%, 43%, 63% & 42% of the cases respectively . Singapore identified a much lower percentage of patients with lymphopenia, as did a retrospective analysis of COVID-19 patients from Zhejiang Province, which is located ~450 miles from Wuhan(17,18). Conversely, in a series of patients from Italy, patients presenting in the emergency department demonstrate lymphopenia in many cases[19]. The reasons for these discrepancies are unclear and can be multifactorial, although geographical variation is possible.

An increased number of neutrophils i.e. neutrophilia was seen in 61% of the cases in our study where as in studies done by like Chen et al[20], Liu et al[15]& Wu et al[16] it is 38%, 17% & 20% respectively. The available data suggest that neutrophilia is an expression of the cytokine storm and hyperinflammatory state which have an important pathogenetic role in COVID-19 and related infections such as SARS [21-23]. Neutrophilia may also indicate superimposed bacterial infection[24].

Leucocytosis was seen in 39% of the cases in our study as compared to other studies like Chen et al[20]where it is 24% , 30% in study done by Huang et al[14]& 10% in study done by Wu et al(16) . Leukopenia was seen in only few cases (3 %) in our study while in other studies conducted by Xu et [17]al it was found in 31% cases, in study by Huang et al [14]it is 25% & 9 % in study done by Wu et al[16]. The total leukocyte count varies among patients, which may reflect the dominance of either lymphopenia or neutrophilia. Leukocytes and neutrophils were also significantly higher in a severe group in a study conducted on 94 patients at Shenzhen Third People's Hospital [25].

The thrombocyte count was seen in 19% of the cases in our study which was found to be almost similar to the studies done by Chen et al[20]and Wan et al [26]in which thrombocytopenia is seen in 17% cases while it was 8% in study by Liu et al[15], whereas studies like Huang et al[14] and Xu et al[17] shows thrombocytopenia in 5 % cases only. Additionally, Xu et al. revealed in their study that thrombocyte counts are significantly low in pneumonia patients and that this decrease is directly proportional to the patients clinical status [27]

In our study , increased neutrophil to lymphocyte ratio is seen in 60% of cases. Yang et al. reported that the elevated neutrophil-to-lymphocyte ratio (NLR) may predict COVID-19 prognosis [28].Although extensive study is at this point lacking, Qin et al have reported an increase in NLR in patients with severe disease compared to those without[23].

V. Conclusion:

Lymphopenia, neutrophilia, thrombocytopenia, and leucocytosis in general are some findings seen in most of the COVID-19 patients. Also elevated neutrophil-to-lymphocyte ratio may be related to the severity of the infection and can be used as an important biomarker for COVID-19 patients. Despite the limitations, the analysis of the current scientific literature demonstrates the value of laboratory parameters as simple, rapid, and cost-effective biomarkers in COVID-19 patients.

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