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Haematological Profile of COVID-19 in COVID-19 Hospitals in Central India

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Abstract
The diagnosis of COVID-19 with prognosis can be done by the basic complete blood count (CBC) in an economical manner. It also helps in the clinical monitoring of these patients. Lymphopenia, thrombocytopenia and increased RDW are observed in COVID-19 patients. The presentstudy was conducted in a special COVID-19 Hospital in Mujaffarpur, Bihar
Two hundred seventeenCOVID-19 positive patients were studied. Lymphopenia was seen in 57 and thrombocytopenia in 33 Covid 19 positive patients. RDW was increased in
Keywords: *Haematology profile, lymphopenia, thrombocytopenia, increased RDW, COVID-19*

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I. Introduction

Coronaviruses (CoVs) are a large viruses group belonging to the CORONAVIRIDAE family [1,2], presenting a single-stranded RNA genome [3]. Wuhan Municipal Health Commission, Hubei Province, China, on 31 December 2019 reported the existence of 27 cases of patients with pneumonia of unknown etiology. WHO issued a worldwide public health alert regarding the emergence of a new epidemic viral disease [9] on January 30, 2020.

WHO announced the name for the epidemic disease caused by SARS-CoV-2: coronavirus disease 2019 (COVID-19) on February 11,2020 and declared on March 11, 2020, a pandemic state [10]. SARS-CoV-2 spread occurs by inhalation or ingestion of viral droplets. Thus, the main sources of human infection are contact with any contaminated surfaces (viral droplets). Therefore, the correct hand hygiene, use of personal protective equipment's and social isolation are very important strategies in combating the transmission of SARS-CoV-2 .Quarantine measures should be established to restrict the movement of uninfected people in regions where there is an epidemic outbreak and infected people, who can act as spreading the virus agents as long as the symptoms last until clinical recovery [11]

II. Material And Methods

The present study was carried out in a COVID19 Naraina group hospital,, 307 patients tested positive for COVID-19 were studied. Thirty percent of patients were in the age profile of 41 to 50 years There were 77 females out of a total of 307 COVID-19 patients. 5

LABORATORY DIAGNOSIS

The most common hematological findings include lymphocytopenia [12], neutrophilia, eosinopenia mild thrombocytopenia [13] and, less frequently, thrombocytosis The presence of reactive lymphocytes has been reported only occasionally The leukocyte count may be normal, reduced or increased According to a META-analysis [14] leukocytosis, lymphopenia and thrombocytopenia are associated with greater severity and even fatality in COVID-19 cases. Main laboratory changes in patients with an unfavorable evolution of SARS-CoV-2 infection are shown in Fig. 1.

In the present study lymphopenia, thrombocytopenia and increase in RDW was observed, as seen in other studies. Since December 2019, the SARS-CoV-2 was rapidly spreading among humans and it became a pandemic. Currently, scientific knowledge about the SARS-CoV-2 origin, virulence and spread is still not well established, which corroborates the existence of several gaps, ranging from the understanding of COVID-19 pathophysiology to the discovery of an effective antiviral drug therapy and a vaccine as shown in Table 1.

Table 1: Main laboratory abnormalities related to diagnosis and/or prognosis of SARS-CoV-2 infection.

Laboratory parameters	Abnormalities	References
Lymphocytes	Reduction	Chan et al., 2020; Chen et al., 2020; Guan et al., 2020; Huang et al., 2020; Liu et al., 2020; Wang et al. 2020; Zhou et al., 2020;
		Young et al., 2020; Sun et al., 2020
Platelets	Reduction	Chan et al., 2020; Chen et al., 2020; Guan et al., 2020
	Increase	Ruan et al., 2020; Lippi et al., 2020
Neutrophils	Increase	Chen et al., 2020; Wang et al. 2020
	Reduction	Liu et al., 2020
Eosinophils	Reduction	Sun et al, 2020; Zhang et al, 2020; Liu et al., 2020.
Leukocytes	Reduction	Guan et al., 2020; Huang et al., 2020
	Increase	Chen et al., 2020; Wang et al., 2020; Zhou et al., 2020
C-reactive protein (CRP)	Increase	Chan et al., 2020; Chen et al., 2020; Guan et al., 2020; Liu et al., 2020; Ruan et al., 2020; Young et al., 2020
Ferritin	Increase	Chen et al., 2020; Zhou et al., 2020
Procalcitonin	Increase	Chen et al., 2020; Wang et al. 2020; Zhou et al., 2020
Lactate dehydrogenase (LDH)	Increase	Chan et al., 2020; Chen et al., 2020; Liu et al., 2020; Wang et al. 2020; Zhou et al., 2020
D-dimer	Increase	Chen et al., 2020; Huang et al., 2020; Tang et al., 2020; Wang et al. 2020; Zhou et al., 2020
Hemoglobin (Hb)	Reduction	CHEN et al., 2020
Troponin	Increase	Huang et al., 2020; Ruan et al., 2020; Wang et al. 2020; Zhou et al., 2020
Myoglobin	Increase	Ruan et al., 2020
Angiotensin II	Increase	Liu et al., 2020
Cytokines	Increase	Fu et al., 2020; Huang et al., 2020; Ruan et al., 2020; Zhou et al., 2020
Prothrombin time	Increase	Huang et al., 2020; Tang et al., 2020; Zhou et al., 2020
Aspartate aminotransferase (AST)	Increase	Chen et al., 2020; Huang et al., 2020; Wang et al. 2020
Alanine aminotransferase (ALT)	Increase	Chen et al., 2020; Wang et al. 2020; Zhou et al., 2020
Total bilirubin	Increase	Wang et al., 2020
Creatinine	Increase	Wang et al., 2020; Zhou et al., 2020

III. Results

The result of the present studies in the two hospitals are shown in Tables 2, 3 and 4.

2: Lymphocyte count in COVID-19 patients

Hospital	Total number	Low lymphocyte count	Normal lymphocyte count
Covid19 Hospital Muzaffarpur, (Central India)	217	57 (26%)	160

Table 3: Platelet Count in COVID-19 patients

Hospital	Total number	Low platelet count	Normal platelet count
Covid19 Hospital Muzaffarpur, (Central India)	217	33 (15%)	184

Table 4: RDW in COVID-19 patients

Hospital	Total number	RDW	Normal RDW
Covid19 Hospital Muzaffarpur, (Central India)	217	24 (11%)	173

P value is <0.000001

Result is highly significant at P<0.05

Tables 2, 3, 4 showed the CBC profile in COVID-19 positive patients in the covid19 hospital. In the present study lymphopenia was observed in 182out of 307 COVID-19 patients. Thrombocytopenia was seen in 107 out of 217 and 54 out of 307 COVID-19 patients. RDW was increased 41out of 307 COVID-19 patients.

IV. Discussion

As already reviewed by Terpos et al. [15] such abnormalities have been reported by several authors and are associated, in different parts of the world, the need for ICU admission and SARS development. Still according to these authors, during the first days of the disease, when patients manifest non-specific symptoms, the leukocyte count and the absolute value of lymphocytes are normal or slightly reduced.

The latter showed their nadir for lymphocytopenia around the 7th day of symptoms, with subsequent recovery Thus, on the basis of Terpos et al. [15] it is possible to admit that the dynamics of the absolute lymphocyte count, that is, its serial count may be predictive of the clinical outcome of patient. An analysis of the literature revealed that among all the hematological abnormalities, lymphocytopenia has been highlighted as the most frequent since ad- mission to death 16 From data based on the complete blood count, it is possible to calculate ratios between its parameters, whose interpretation has considerable clinical value. Thus, a decreased lymphocyte/leukocyte count ratio has already been reported indicating severe disease and/or fatal outcomes. Similarly, increased

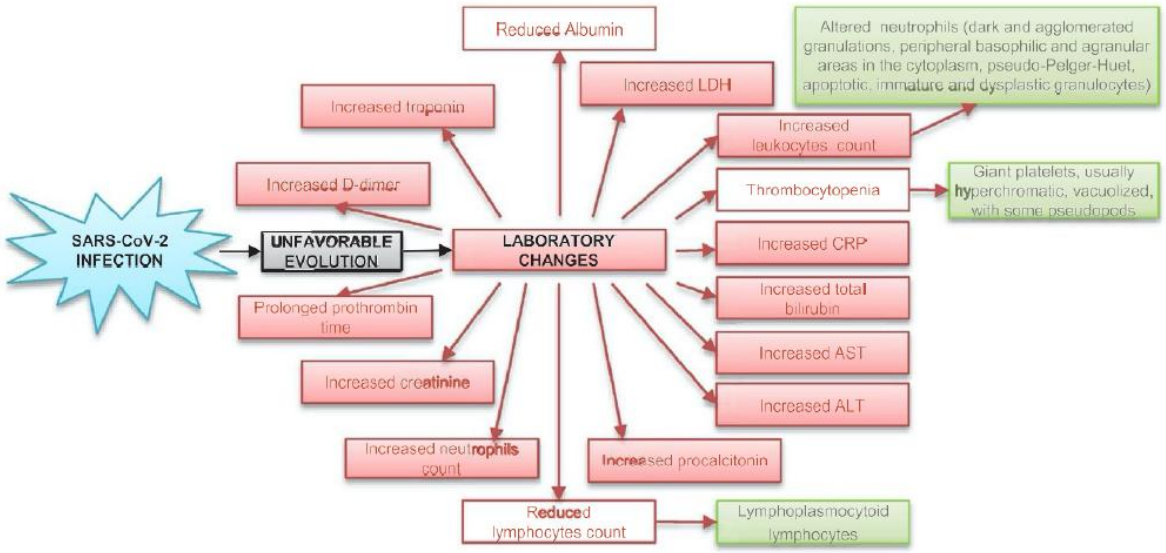

Fig. 1. Main laboratory changes in COVID-19

worsening COVID-19, D-dimer levels become raised, with formation of microthrombi in peripheral blood vessels and recurrent coagulation disorders.

Most of the patients who died had diagnostic criteria for disseminated intravascular coagulation (DIC). It is stressed that the evaluation of the hemostatic system by specific tests should integrate the routine clinical monitoring of the patient with COVID-19, in view of fulfillment of the laboratory criteria for the diagnosis of DIC in nearly three quarters of patients who died.

Main laboratory changes, especially hematological ones, related to the diagnosis and/or prognosis of SARS- CoV infection are shown in Table 1.

Guan et al. [12] extracted data from COVID-19 patients (N = 1099) in 552 hospitals, in 30 provinces, autonomous regions and municipalities in China. Upon admission, the disease was classified as severe in 173 patients and non-severe in 926 patients. The first group had major laboratory abnormalities, such as lymphopenia and leukopenia than those with non-severe disease. Of these patients, 83.2% had lymphopenia; 36.2% thrombocytopenia; 33.7% leukopenia and most of them had high levels of CRP. In a retrospective cohort study , with 191 patients at Jinyintan Hospital and Wuhan Pulmonary Hospital, China, lymphopenia occurred in 40% of these patients, in addition to leukocytosis, increased LDH, ALT, highly sensitive cardiac troponin I, serum ferritin, creatine kinase (CK), D-dimer, prothrombin time, creatinine, IL-6 and procalcitonin, whose parameters were shown to be associated with hospital death. D-dimer levels above 1 µg/mL at ad- mission were associated with a greater chance of death. Lymphocyte count was significantly higher in surviving patients than in non survivors. It is noteworthy that in survivors, the lymphocyte count was lower on the 7th day after onset of the disease and improved during hospitalization, while severe lymphopenia was observed until death in non

survivors. D-dimer levels, high sensitivity cardiac troponin I, LDH, IL-6 and ferritin were higher in non survivors compared to survivors and increased with disease progression. Thus, the levels of D-Dimer and highly sensitive cardiac troponin may indicate a greater or lesser risk of death for patients with SARS-CoV-2 infection. Furthermore, lymphopenia seems to be one of the most relevant hematological ab- normalities in COVID-19, its use being suggested as a severity bio- marker of this infection.

In addition, it was found that during hospitalization, most patients had marked lymphopenia and in non-survivors lymphopenia worsened over time. Leukocyte and neutrophil counts, and D-Dimer levels were higher in non survivors than in survivors.Lymphopenia was seen in 57 and thrombocytopenia in 33 Covid 19 positive patients. RDW was increased in 24 Covid positive patients as seen in other studies.

With COVID-19 is suggested that substantial efforts be made to develop an index or algorithm with good prognostic accuracy for patients with this disease. According to the literature available at the time on SARS-CoV-2 infection, there is scientific evidence of major laboratory changes reflecting systemic inflammation predictors of unfavorable clinical out- comes, such as admission to ICU or even death. Given the above, the present literature review may be relevant, not only to disseminate what is already known, but it may also serve as a valuable base for future investigations. The search for routine hematological and biochemical variables and others that may assist in the clinical diagnosis of patients suspected of being infected with SARS-CoV-2, or that can predict the severity of the disease or even serve for its. Statistical and machine learning models with high predictive power and consistency with the reality known and accepted by medical specialists in relation to SARS-CoV-2 infection would be extremely welcome in the current pandemic scenario that may continue for a time not yet predictable. We believe that a tool with such characteristics would have a potential value in clinical practice, considering its efficiency, the ease and speed in obtaining laboratory data, in addition to its low cost.

Blood group "O" is associated with a lower risk of infection by SARS-CoV-2 compared to non-O blood groups, while blood group A was associated with a greater risk than those non-A.

V. Conclusion

As shown in the present multicentric study lymphopenia, thrombocytopenia and increased RDW are important findings in COVID-19 patients monitoring is highly desirable at a time of great challenge imposed by the pandemic and impairment that spans, to a lesser or greater extent the renal, hepatic, cardiac, immune, hemostatic, bone marrow, and peripheral blood systems, among others. For example, among the hematological parameters, lymphopenia can be used to discriminate patients at risk for SARS.

Available data suggest that several hematological parameters may change in the course of SARS-CoV-2 infection and that some of them can be considered significant

In today's challenging times, more than ever, the clinical laboratory needs to be patient-centered and with qualified leadership to be safe, efficient, effective and timely.

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