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Evaluation of Hematological Parameters of COVID-19 Positive Cases Followed in a Tertiary Education and Research Hospital: A Single-Center Study

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ABSTRACT

Introduction and aim: The COVID-19 pandemic or Coronavirus pandemic is a virus outbreak that emerged on November 17, 2019 in Wuhan, the capital of the Hubei region of China. A new Coronavirus, called SARS-CoV-2, was diagnosed after several patients developed pneumonia that developed without a specific cause and did not respond to treatment and vaccines. It was recognized as a pandemic by the World Health Organization (WHO) on 11/03/2020. In our study, it was aimed to retrospectively evaluate the hematological parameters of the cases that we followed in a tertiary education and research hospital pediatric health and diseases clinic.

Materials and methods: COVID-19 positive cases followed between 11/03/2020-01/06/2020 in the pediatric health and diseases clinic of our hospital were determined retrospectively. Symptoms, physical examination findings and laboratory results of the cases were evaluated. This study was started after the approval of the ethics committee.

Results: 150 cases, 73 males and 77 females, were included in the study. The age of the children varies between 2-216 months, with an average of 112 months. When looking at the laboratory parameters, the lowest, highest and average values are respectively WBC: 2500-21500/mm^3 (7223) ANS: 810-10030/mm^3 (3658), ALS: 640-13250/mm^3 (2723), NLR (Neutrophil Lymphocyte Ratio): 0.08-11.2 (2.05), monocyte: 10-6100/mm^3 (596.4), eosinophil: 0-930/mm^3 (150.2/mm^3), Hb: 9.4-17 g/dL (12.9), Plt: 97000-470000/mm^3 (255543) MPV:6.5-13.4 (8.93), MCV: 60.9-94 (81.63) RDW: 11.7-36% (13.59), PDW: 8.7-16.7% (15.76) CRP: 0-5.7 mg/L (0.36), AST: 8-97 U/L (25.6) ALT: 7-90 U/L (18.7) LDH: 143-865 U/L(248.8), urea: 1-865 mg/dL (16.9), creatinine: 0.14-1.4 U/L (0.62), troponin (pg/ml): 0-26.5 (1.8), D-dimer (µg/ml): 0-8.79 (0.5) determined.

Discussion and conclusion: In many studies conducted in our country and around the world, the clinical relationship between hematological parameters and COVID-19 infection has been examined.

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When studies conducted in the USA and China is examined, it is seen that the most common clinical finding in COVID-19 is lymphopenia. In severe cases of COVID-19, there is usually an increase in the neutrophil count. The ratio of Neutrophils to Lymphocytes (NLR) is an important indicator of inflammation, and its high detection is considered significant in terms of systemic inflammation, but it is also accepted as an indicator of poor prognosis in patients. It is thought that there may be a negative relationship between the number of eosinophils and the clinical presentation of the disease. The incidence of thrombocytopenia increases in severe cases of COVID-19. Hematological parameters have an important place in the diagnosis and follow-up of COVID-19. Clinical presentation of the cases and laboratory findings should be evaluated together.

Keywords: COVID-19; Child; Lymphopenia; Leukopenia; Leukocytosis; Neutrophil Lymphocyte ratio; Neutrophilia; Neutropenia; Pneumonia; Thrombocytopenia

INTRODUCTION

The COVID-19 pandemic or coronavirus pandemic is a virus outbreak that emerged on November 17, 2019 in Wuhan, the capital of the Hubei region of China. A new Coronavirus, called SARS-CoV-2, was diagnosed after several patients developed pneumonia that developed without a specific cause and did not respond to treatment and vaccines. It was recognized as a pandemic by the World Health Organization (WHO) on 11/03/2020. In our study, it was aimed to retrospectively evaluate the hematological parameters of the cases that we followed in a tertiary education and research hospital pediatric health and diseases clinic.

MATERIALS AND METHODS

This study started after the approval of the university of health sciences, Umraniye training and research hospital medical scientific and ethical committee (date: 28/04/2020, decision no: 139). COVID-19 positive cases followed between 11/03/2020-01/06/2020 in the pediatric health and diseases clinic of our hospital were determined retrospectively. Symptoms, physical examination findings and laboratory results of the cases were evaluated (Table 1). This study was started after the approval of the ethics committee [1-3].

Table 1: Hematologic parameters references.

	0-3 age	3-5 age	5-11 age	>11 age	<1 age	≥ 1 age	Normal range (2-12 age)
Leucocytosis	>13000	>12900	>10400	>10400	-	-	-
Leucopenia	<7000	<4400	<3800	<3800	-	-	-
Lymphocytosis	>6400	>5300	>3900	>3200	-	-	-
Lymphopenia	<2400	<1600	<1400	<1000	-	-	-
Neutropenia	-	-	-	-	>8500	>8000	-
Neutrophilia	-	-	-	-	<1500	<1000	-
Eosinopenia	<500	<500	<500	<500	-	-	-
Eosinophilia	>500	>500	>500	>500	-	-	-
D-Dimer (mg/L)	-	-	-	-	-	-	0.4-2.27

RESULTS

150 cases, 73 males and 77 females, were included in the study. The age of the children varies between 2-216 months, with an average of 112 months. Computed tomography was performed in 30 cases. Pulmonary involvement was present in 15 cases in computed tomography. There was unilateral involvement in 7 cases and bilateral involvement in 8 cases. Clinically, 9 cases were mild, 5 cases were moderate, 1 case was severe. The first PCR test of all cases was positive. The second test of 13 cases was also positive. 23 cases were followed up in the hospital. One case was followed up in the intensive care unit. The remaining cases were followed up at home. There was no case with exitus. 78 cases did not receive treatment. Oseltamivir in 23 cases, azithromycin in 43 cases, hydroxychloroquine in 13 cases, ceftriaxone in 4 cases, ampicilline-sulbactam in 1 case, and amoxicilline-clavunate in 1 case were started. Asthma was present in 2 cases as a comorbid disease (Table 2) [4-7].

Table 2: The demographic and clinical characteristics of children with COVID-19.

Characteristics		N	%
Gender	Male	73	50.2
	Female	77	49.8
Computed Tomoghraphy (CT)	-	120	80
	+	30	20
Disease's severity	Mild	9	6
	Moderate	5	3.3
	Severe	1	0.6
PCR test (+)	1	150	100
	2	13	2.8
	3	2	1.3
Involvement	Unilateral	7	4.7
	Bilateral	8	5.3
Surveillance	Home	126	84
	Hospital	23	15.3
	Intensive care	1	6.7
Treatment	Absent	78	52
	Oseltamivir	23	15.3
	Azythromicine	43	28.7
	Hydroxychloroquine	13	8.7
	Ceftriaxone	4	2.7
	Ampicilline-sulbactam	1	0.7
	Amoxicilline-clavunate	1	0.7

When looking at the laboratory parameters, the lowest, highest and average values are respectively WBC: 2500-21500/mm^3 (7223), ANS: 810-10030/mm^3 (3658), ALS: 640-13250/mm^3 (2723), NLR (Neutrophil Lymphocyte Ratio): 0.08-11.2 (2.05), Monocyte: 10-6100/mm^3 (596.4), Eosinophil: 0-930/mm^3 (150.2/mm^3), Hb: 9.4-17 g/dL (12.9), Plt: 97000-470000/mm^3 (255543), MPV: 6.5-13.4 (8.93), MCV: 60.9-94 (81.63) RDW: 11.7%-36 (13.59), PDW: 8.7-16.7% (15.76) CRP: 0-5.7 mg/L (0.36), AST: 8-97U/L (25.6), ALT: 7-90U/L (18.7) LDH: 143-865 U/L (248.8), urea: 1-865 mg/dL (16.9), creatinine: 0.14-1.4 U/L (0.62), troponin (pg/ml): 0-26.5 (1.8), D-dimer (µg/ml): 0-8.79 (0.5) determined (**Table 3**) [8,9].

Table 3: Evaluation of laboratory and radiological findings of children with COVID-19.

Variable	Mean ± Standard deviation
WBC (White Blood Cell) (mm^3)	7223 ± 0.3 (2500-21500)
ANC (Absolute Neutrophil Count) (mm^3)	3658 ± 0.2 (810-10030)
ALC (Absolute Lymphocyte Count) (mm^3)	2723 ± 0.2 (640-13250)
NLR (Neutrophile Lymphocyte Ratio)	2.05 ± 0.5 (0.08-11.2)

Monocyte (mm^3)	596.4 ± 1.1 (10-6100)
Eosinophil (mm^3)	150.2 ± 0.4 (0-930)
Hemoglobin (Hgb) (g/dL)	12.9 ± 1.4 (9.4-17)
Platelet (Plt) (mm^3)	255543 ± 0.6 (97000-470000)
MPV (fL)	8.93 ± 0.7 (6.5-13.4)
MCV (fL)	81.63 ± 0.73 (60.9-94)
RDW (%)	13.59 ± 0.3 (11.7-36)
PDW (%)	15.76 ± 0.2 (8.7-16.7)
CRP (mg/L)	0.36 ± 0.4 (0-5.7)
AST (U/L)	25.6 ± 0.2 (8-97)
ALT (U/L)	18.7 ± 0.7 (7-90)
LDH (U/L)	248.8 ± 0.5 (143-865)
Urea (mg/dL)	16.9 ± 0.3 (1-865)
Creatinine (U / L)	0.62 ± 0.2 (0.14-1.4)
Troponin (pg/ml)	1.8 ± 0.1 (0-26.5)
D-dimer (µg/ml)	0.5 ± 0.1 (0-8.79)

There were leukocytosis in 8 cases, leukopenia in 10 cases, lymphocytosis in 25 cases, lymphopenia in 35 cases, neutrophilia in 2 cases, neutropenia in 21 cases, eosinophilia in 8 cases, and eosinopenia in 33 cases. D dimer was found to be normal in 23 cases, high in 1 case, and low in other cases (**Table 4**).

Table 4: Hematologic parameters in COVID-19 cases.

	0-3 age (N/%)	3-5 age (N/%)	5-11 age (N/%)	>11 age (N/%)	<1 age (N/%)	≥ 1 age (N/%)	Total (N/%)
Leucocytosis	1/12.5	3/37.5	2/25	2/25	-	-	8/100
Leucopenia	2/20	3/30	3/30	2/20	-	-	10/100
Lymphocytosis	3/12	2/8	7/28	13/52	-	-	25/100
Lymphopenia	4/11.5	11/31.4	8/22.8	12/34.3	-	-	35/100
Neutropenia	-	-	-	-	1/50	1/50	2/100
Neutrophilia	-	-	-	-	12/57	9/43	21/100
Eosinopenia	2/25	3/37.5	1/12.5	2/25	-	-	8/100
Eosinophilia	3/9.1	12/36.4	8/24.2	10/30.3	-	-	33/100

DISCUSSION

In many studies conducted in our country and in the world, the clinical correlation between hematological parameters and COVID-19 infection has been examined. When studies from the USA and CHINA are examined, it is seen that the most common clinical finding in COVID-19 is lymphopenia. In severe infection due to SARS-CoV-2, viruses entering the body can cause viremia, increase inflammatory cytokines in the body, and cause lymphocytes to go to apoptosis, thus causing lymphopenia. As with many viral infections, SARS-CoV-2 infection can impair the immune function of $CD4^+$ T lymphocytes and reduce the cytokine secreting ability of $CD4^+$ T lymphocytes and CD8 T lymphocytes are also becoming weaker in strength. In severe cases of COVID-19, there is usually an increase in the neutrophil count. The ratio of

Neutrophils to Lymphocytes (NLR) is an important indicator of inflammation, and its high detection is considered significant in terms of systemic inflammation, but it is also considered an indicator of poor prognosis in patients. Although eosinopenia and eosinophilia are seen in COVID-19 cases, the prognostic effect of eosinophil count is not fully known. It is thought that there may be a negative relationship between the number of eosinophils and the clinical presentation of the disease. Although thrombocytopenia is not as common as lymphopenia, it can be seen in SARS-CoV-2 cases. The incidence of thrombocytopenia is increasing in severe COVID-19 cases. High D-dimer levels may be associated with acute lung injury and are thought to be significant in terms of disease severity [10].

CONCLUSION

In many studies conducted in our country and around the world, the clinical relationship between hematological parameters and COVID-19 infection has been examined. When studies conducted in the USA and China is examined, it is seen that the most common clinical finding in COVID-19 is lymphopenia. In severe cases of COVID-19, there is usually an increase in the neutrophil count. The ratio of Neutrophils to Lymphocytes (NLR) is an important indicator of inflammation, and its high detection is considered significant in terms of systemic inflammation, but it is also accepted as an indicator of poor prognosis in patients. It is thought that there may be a negative relationship between the number of eosinophils and the clinical presentation of the disease. The incidence of thrombocytopenia increases in severe cases of COVID-19. Hematological parameters have an important place in the diagnosis and follow-up of COVID-19. Clinical presentation of the cases and laboratory findings should be evaluated together.

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