Hematological and Coagulation Features of COVID-19Patients in Hodeidah, Yemen

Abstract :

Background: The blood parameters are very important markersfor theprogression of COVID-19infection and predicator for severity.

Objectives: Therefore, the study aimed to describe thehematological and coagulation features of coronavirus disease 2019 (COVID-19) infection.

Methodology: Thedescriptive study (a case series) included 49 patients that were diagnosed clinically and confirmed by the real time – polymerase chain reaction (RT-PCR) with COVID-19. The patients were extremely debilitated and the critical cases were treated in the isolation center (inpatient).

Results: The resultsrevealed that 85.7%of the patients had pretreatment leukocytosis with averagecount of WBC 15.24 ± 6.18 ($\times 10^{9}$/L) .On the other hand, the WBC count, which had reached a peak of 34 ($\times 10^{9}$/L) as maximum value. Also, the reduction of the lymphocytes (lymphopenia) associated with COVID -19 infection was up to 1 % with average (8.75 ± 6.92 %). The neutrophils increased (neutrophilia) to 98 % with average (87.40±8.45%). In addition, the thrombocytopenia was reported in 2/49 cases (4.08 %), and low in hemoglobin (severe anemia) was reported in 5/49 case (10.20 %) . The coagulation tests revealed increased in d-dimer levels ($p< 0.05$) in severe and critical patients. On the other hand , the results showed normal in prothrombin time (PT) and partial thromboplastin (PTT) ($p> 0.05$).

Conclusion: The study concluded that decrease in lymphocytes (lymphopenia) ,increase in NLR in patients with severe COVID-19 infection . and increase in D-dimer are good predicator for progressive and severity illness in COVID-19 infection .

Keywords:COVID-19 , Hematological, Hodeidah,Yemen

1.INTRODUCTION

“The hematological parameters are described as predictors for the severity and progression of COVID-19 infection. The COVID-19 disease was firstly reported in Wuhan, China, in December 2019” [1]. “The novel contagious disease was caused by an unfamiliar coronavirus related to the virus that caused the SARS (severe acute respiratory distress syndrome) outbreak in 2002 (SARS-CoV) and Middle East respiratory syndrome (MERS) outbreak in 2012. It should be regarded as a systemic disease involving multiple systems are involved including cardiovascular, respiratory, gastrointestinal, neurological, hematopoietic and immune system” [2]. “Of leucocytes, the neutrophils are the most distinctive and essential component of the immune system. The role of lymphocytes in infections is well evidenced. Moreover, thrombocytes have a crucial role in the regulation of several inflammatory processes” [3,4].

“The clinical hematology laboratory plays an important role by providing the clinical team a number of useful prognostic markers” [4].“Although information is in some cases based on the results of limited amount of data and should be validated with additional studies, the available findings clearly establish the clinical hematology laboratory as an important partner in the triage and management of affected patients. The results of a complete blood count (CBC) can provide information about not only the number of cell types but can also give an indication of the physical characteristics of some of the cells. Also, these parameters play an important role in helping doctors to know these values in a true way so that they can come to a sound diagnosis” [5].Therefore, the study aimed to describe thehematological features of COVID-19 infection.

2. METHODOLOGY

3.1. Study area

Center of Tropical Medicine and Infectious Diseases (CTMID), Al Thawara Public Hospital Authority, Hodeidah, Yemen from 1st June to 31st December 2020. Note : The area is endemic of vector – borne diseases (VBDs) such as the malaria , dengue and vaccine – preventable diseases (VBDs) that cause other infection (coinfection) to effect on hematological parametric [6-10].

3.2. Study design

This study was designed in a case series. It focuses on the patients who sought care at the emergency team, COVID-19 isolation department.

3.3. COVID-19 confirmation

49 severe and critical patients were confirmed and admitted in the COVID-19 isolation department, which was located at CTMID. Nasopharyngeal swabs were collected and verified by Real Time - Polymerase Chain Reaction (RT-PCR), oxygen saturation, radiological and hematological findings were tested. The severe cases is defined that clinical signs of pneumonia (fever, cough, dyspnea, fast breathing) plus one of the following: respiratory rate > 30 breaths/min; severe respiratory distress; or SpO2 < 90% on room air. The critical cases is defined that the multi-organ failure[11-16].

3.4. Samples collection

Whole blood samples namely 49 (40 male and 9 female) were taken before treatment and collected into the ethylenediaminetetraacetic acid (EDTA) tube, and then sent to the clinical laboratory for analysis of standard clinical tests within two hours.

3.5. Hematological and blood coagulation assays

Hematological parameters namely RBC, WBC and Platelets were analyzed by Sysmex XE-5000 automated hematology analyzer (Sysmex, Japan). Also, coagulation tests as Prothrombin time (PT), Partial Prothrombin Time (PTT), International Normalized Ratio (INR) and d-Dimer were measured based on standards methods.

3.6. Data analysis

The variables studied namely age and gender that were collected from triage area. Data on clinical symptoms, hematologicaland coagulation parameters by patients with severe and critical

COVID-19 were recorded. Data were checked and entered in Statistical Package for Social Science (SPSS) and Microsoft Excel. The data were subsequently visualized using tables, graphs and text. Data were described through calculations of medians, ranges, frequencies and percentages. Comparisons between qualitative variables were analyzed using Chi-squared test.

1. RESULTS

3.1. Patients Characteristics

The background information of personal demographic and clinical data on the 49 patients that were admitted in COVID-19 isolation department , CTMID , AL Thawarah Public Hospital Authority in Hodeidah, Yemen and were summarized in Table 1.

Table 1. Patients Characteristics of COVID-19

Variables	(n)	(%)	X^2	p – value
Gender				
Male	40	81.63	19.62	0.00001*
Female	9	18.37		
Total	49	100		
Age				
<15	3	6.12		
15-29	2	4.10		
30 -49	11	22.44	20.29	0.00044 *
50-59	17	34.69		
60+	16	32.65		
Total	49	100		
Clinical symptoms				
• Difficulty breathing	42	85.7		
• Fever	30	61.2		
• Cough	20	40.8		NA
• Joints pains	16	32.65		
• Sore throat	14	28.6		
• Headache	3	6.12		
Severity illness				
Severe cases	21	42.86		NA
Critical cases	28	57.14		
Total	49	100		

* Significant (p - value < 0.05)

3.2. Hematological Characteristics

3.2.1. Red Blood Cells and Hemoglobin

Anemia was reported in 50 % of cases (10.4 ± 3.5) and bloodtherapy was transfused into 10.20 % of cases in their treatment ; however, the RBC don’t changein response.

Table 2. Results of RBC count , Hb and PCV

Parameters	Mean ± SD (n = 49)	*p* value
RBC ($\times 10^{12}$/L)	4.34±0.95	
Median	4.45	$p< 0.05$
Rang	2.1-5.93	
Normal values	5.5±1.0	
Hb(g/dl)	10.84 ±2.16	
Median	10.8	$p<0.05$
Rang	6.4 -16.5	
Normal values	15.5 ± 2.5	
PCV (%)	34.19 ±5.94	
Median	34.01	$p< 0.05$
Rang	20.8 -46.3	
Normal values	37.5 ± 47.5	

3.2.2. White Blood Cells and Differential Count

The analysis revealed that 85.7% (n=42) patients had leukocytosis pretreatment with average count of WBC 15.24 ± 6.18 (×10 9/L) . The highest level of WBC was 34 (×10 9/L).Also, lymphocytes decreased (lymphopenia) with COVID -19 infection to 1 % with average (8.75±6.92%). In addition, neutrophils increased (neutrophilia) to 98 % with average (87.40±8.45%).

Table 3. Results of WBC and Differential Count Parameters

Parameters	Mean ± SD (n = 49)	*p* value
WBC($\times 10^{9}$/L)	15.24±6.18	$p<0.05$
Median	14.7	

Rang	5.6-34.0	
Normal values	3.5±7.5	
Neutrophil (%)	87.40 ± 8.45	$p<0.05$
Median	90	
Rang	60-98	
Normal values	40-75	
Lymphocyte (%)	8.75 ± 6.92	$p<0.05$
Median	6	
Rang	1-32	
Normal values	20-45	
Monocyte (%)	2.61 ± 2.32	$p> 0.05$
Median	3	
Rang	00-12	
Normal values	2-10	
Eosinophil (%)	1.02 ± 1.13	$p> 0.05$
Median	1	
Rang	0-5	
Normal values	1-6	
Basophil (%)	0.06±0.31	$p> 0.05$
Median	0	
Rang	0-2	
Normal values	0-1	

3.2.3. Platelets Count

Platelet count was found in normal range in 40/49 case (81.63 %) of COVID-19 patients. 3/49 (6.12 %) of patients indicated into severe thrombocytopenia (death).On the other hand, 6/49 of cases (12.24%) had increase in the platelets .

Table 4. Results of Platelets Parameters

Parameters	**Mean ± SD (n = 49)**	***p* value**
Platelets ($\times 10^3$/ul)	313.55 ± 139.48	
Median	277	$p> 0.05$
Rang	75-450	
Normal values	150-400	

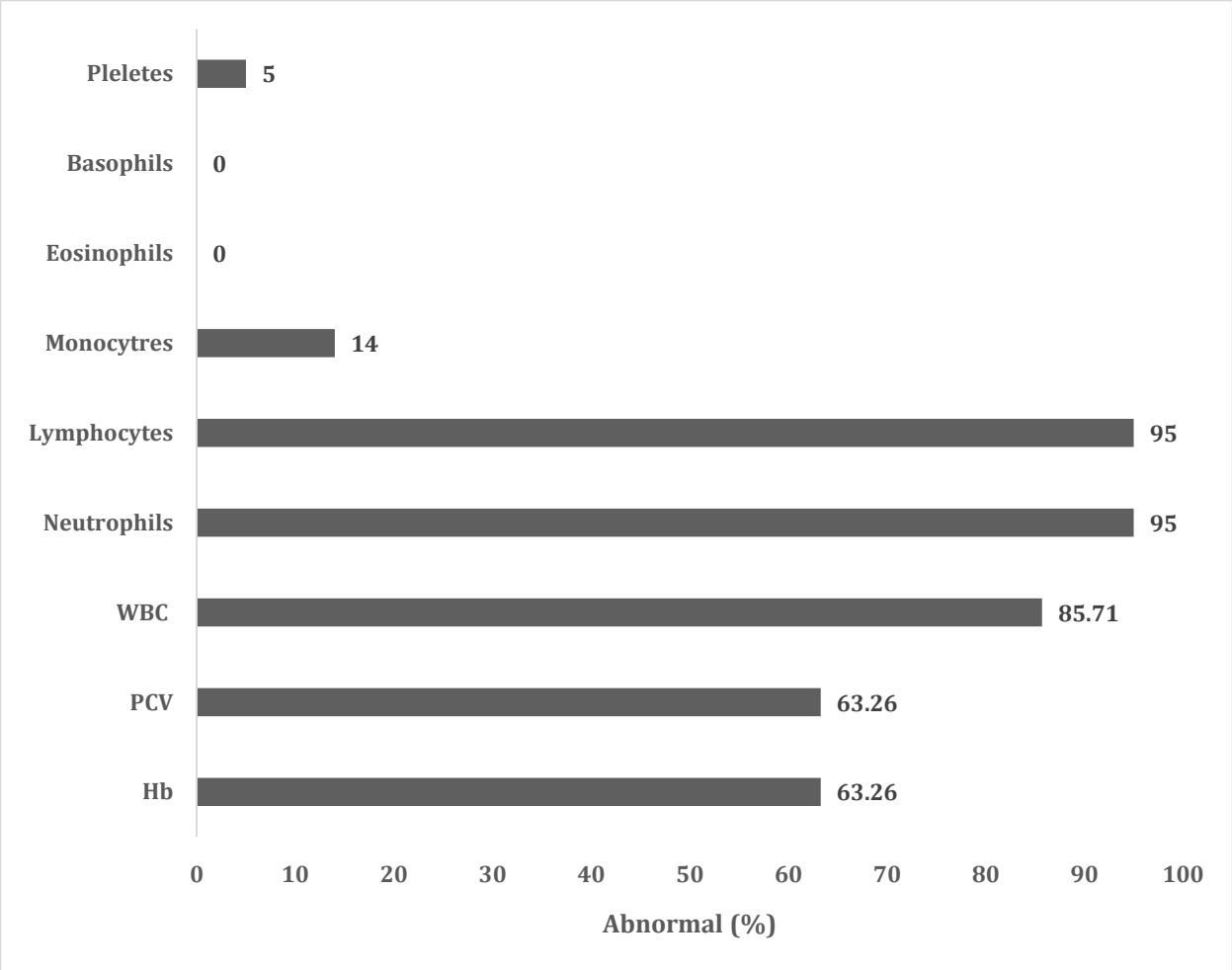

Figure (1) : Abnormalities change percentage of hematological parameters

3.4. Coagulation Parameters

The coagulation tests revealed increase in D-dimerlevels ($p< 0.05$) in severe and critical patients. On the other hand, the results showed no change of referent value normal in prothrombin time (PT) and partial thromboplastin (PTT) ($p> 0.05$).

Table 5 Results of Coagulation Parameters

Parameters	Mean ± SD (n = 49)	*p* value
d-dimer (mg/L)	3.5	
Median	4	$p<0.05$
Rang	1.2 -10	
Normal values	0-0.5	
PT (Second)	11	
Median	10	$p> 0.05$
Rang	10-21	
Normal values	11-14	
PTT(Second)	28	
Median	32	$p> 0.05$
Rang	25-55	
Normal values	25-35	
INR	1.3	
Median	1.1	$p> 0.05$
Rang	1-1.8	
Normal values	Up to 1	

4.DISCUSSION

"Hematologic manifestations ofCOVID-19were initially reported in case series and descriptive studies of COVID-19 patients from China and other countries. Yang et al from China reported that infected with COVID-19 changed the levels of lymphocyte, neutrophil, lymphocyte/monocyte ratio (LMR), andneutrophil/lymphocyte ratio(NLR) in the blood, and these analyzing items were significantly different between the non-severe and severe groups. Furthermore, the dynamic changes of lymphocyte and Neutrophil/lymphocyte ratio(NLR) levels may help discriminate the severe group from the non-severe group"[17,6].Study in Pakistan was reported by Taj et al and concluded that "leukocytosis, neutrophilia, elevated NLR, PTT, D-dimer, lactate dehydrogenase (LDH) and serum ferritin andC reactive protein (CRP) are associated with severity of covid-19 disease"[18,7].

Javadi et al in Iran found that "hemoglobin, WBCs, neutrophil, lymphocytes, and platelets count together with chest tomography score might be beneficial for expedition the diagnosis, assessment the severity of the disease, and outcome in the hospitalized cases, whileCRP and lactate dehydrogenase might be considered as the consequence of lung involvement"[19,8]. Bhandary et al India reported to "the known hematologic parameters implicated in COVID-19 illness such as NLR, eosinopenia and D-dimer, platelet parameters such as mean platelet value (MPV), platelet distribution width (PDW) and plateletcrit(PCT) can also

be used as biomarkers that indicate the severity of the disease"[20,9]."These data, pending further validation, indicate that a decision tree model with hematological parameters could potentially form the basis for a rapid risk stratification tool that predicts COVID-19 severity in hospitalized patients"[21,10].

Other study by Suryawanshi et al in India concluded "a significant decrease in lymphocytic counts was found among severe and critical patients. Hemoglobin level was found to demonstrate higher decrease among severe and critical patients. Platelet count was found in normal range in all COVID-19 patients"[23,12].Terpos et al in Grace reported that "lymphopenia may be considered as a cardinal laboratory finding, with prognostic potential. NLR and peak platelets – lymphocytes ration (PLR)may also have prognostic value in determining severe cases. Elevated D-dimer levels are consistently reported, whereas their gradual increase during disease course is particularly associated with disease worsening. Other coagulation abnormalities such as PT and aPTT prolongation, fibrin degradation products increase, with severe thrombocytopenia lead to life- threatening disseminated intravascular coagulation (DIC), which necessitates continuous vigilance and prompt intervention. So, COVID- 19 infected patients, whether hospitalized or ambulatory, are at high risk for venous thromboembolism, and an early and prolonged pharmacological thromboprophylaxis with low molecular weight heparin is highly recommended. Last but not least, the need for assuring blood donations during the pandemic is also highlighted"[24,13]."Marked elevations in hematologic biomarkers such as lactate dehydrogenase, D-dimer, ferritin, and CRP are associated with worse outcomes. Understanding the pathophysiology and recognizing factors associated with poor prognosis are crucial in improving patient outcomes with coronavirus disease 2019"[26,14].

"In addition , reduction of Hb is found from the study. These variations might be related to the case of infectious diseases, but low in nutritional values and the geographical location of Hodeidah city, Yemen" [5].Another potential application of data derived would be to use formulas such as NLR , and MLR to act as surrogates to assess the extent of systemic inflammation [27,16] , AL Kamarany in Yemen have reported an increase in NLR in patients with severe COVID-19 infection [28,17].

5. CONCLUSION

The study concluded that decrease in lymphocytes (lymphopenia) ,increase in NLR in patients with severe COVID-19 infection . and increase in D-dimerare good predicator for progressive and severity illness in COVID-19 infection .

CONSENT

As per international standards or university standards, Participants' written consent has been collected and preserved by the authors. The raw data are secured in the Center of Tropical Medicine and Infectious Diseases (CTMID), Al-Thawara Public Hospital Authority, Hodeidah, Yemen.

ETHICAL APPROVAL

The studies involving human participants were reviewed and approved by the Ethics Committee of the Center for Tropical Medicine and Epidemiology Studies, Hodeidah University (CTMES – HU), Hodeidah, Yemen.

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COMPETING INTERESTS

Authors have declared that no competing interests exist

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