ORIGINAL ARTICLE

IMPACT OF SEVERITY OF COVID-19 ON HAEMATOLOGICAL PARAMETERS IN PATIENTS REPORTING TO SAIDU GROUP OF TEACHING HOSPITALS, SWAT

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Background: In 2019 novel coronavirus was discovered in Wuhan, China and declared pandemic by world health organization. The disease caused by this virus called coronavirus disease 2019 (COVID-19). Among the corona family the actual virus responsible for COVID-19 is Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). Objective of the study was to determine the pattern of blood parameters in corona virus disease (COVID-19) positive cases and the association of these parameters with severity of COVID-19. M**ethod**: This cross-sectional descriptive study was conducted on 105 participants who were confirmed positive by SARS-CoV-2 through real-time reverse transcriptase PCR, both genders, and Pakistani nationals. The participants who were below 18 years age and missing data were excluded. Haemoglobin (Hb), total leukocyte count (TLC), neutrophil, lymphocyte, monocyte, basophil and eosinophil counts were calculated. Comparison of blood parameters was done among various severity classes of COVID-19 by running one way ANOVA. The level of significance was $p \leq 0.05$. **Results**: The mean age of the participants was 50.6±6.26 years. Males were 78(74.29%) and females were 27 (25.71%). In critical type COVID-19 the mean haemoglobin was least (10.21±1.07 g/dl) and highest in mild cases (15.76±1.16 g/dl) and these differences were highly statistically significant ($p<0.001$). TLC was highest in critical COVID cases ($15.90\pm0.51 \times 10^3/\mu l$) followed by moderate ($12.44\pm0.65 \times 10^3/\mu l$). Similarly, neutrophil count was highest in critical (89±2.1) followed by severe (86±1.12). **Conclusion**: There is significant decrease in mean haemoglobin level and platelet count but increase in TLC in patients infected from COVID-19.

Keywords: Covid-19; Corona virus; Total leukocyte count; Red blood cell; Platelets

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INTRODUCTION

In 2019 novel coronavirus was discovered in Wuhan, China and declared pandemic by world health organization. The disease caused by this virus called coronavirus disease 2019 (COVID-19). Among the corona family the actual virus responsible for COVID-19 is Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2).[1] The usual clinical features of COVID-19 affected patients are dry cough, fever, fatigue, and shortness of breath, etc.[2] Symptoms of gastro-intestinal tract like vomiting, nausea, and diarrhoea can be present in few cases.[3]

As the duration of illness is short in COVID-19 and risk of mortality is quite higher so the early diagnosis of acute respiratory distress syndrome is warranted for prevention of complications.[4] Haematological tests have key role in diagnosis of systemic diseases like COVID-19. Due to inflammatory and immune component in COVID-19 the blood counts change. Haematological analysis valuable in COVID-19 are complete blood counts (CBC), total leukocyte count, differential leukocyte count, platelet count (PLT), haemoglobin level and C-reactive protein. [5]Full blood count is inexpensive and can be performed with ease. Blood indices and ratios of some blood components can provide valuable information.[6,7]

A study by Bellan *et al*[6] conducted on 664 participants who were confirmed positive COVID-19 and reported that blood parameters (platelet count, neutrophil-to-lymphocyte ratio, and red cell distribution width) can predict hospital mortality. Another study was conducted in China on 116 COVID-19 confirmed positive cases and reported the count of platelets, lymphocytes, leucocytes, eosinophils, and haemoglobin was less but monocyte-lymphocyte ratio (MLR) was high as compared to healthy subjects statistically ($p<0.001$).[8]

Previous studies revealed positive association between blood parameters and COVID-19 severity.[6-8] But results can be variable from case to case and population to population. So, this retrospective study was conducted to determine the pattern of blood parameters in COVID-19 positive cases and the association of these parameters with severity of COVID-19.

MATERIAL AND METHOD

This cross-sectional descriptive study was conducted in department of pathology, Saidu medical College, Swat. A

total of 105 participants were selected by non-probability sampling technique from April 2021 to April 2022. A verbal informed consent was obtained from all participants/guardians after the detailed explanation about study. Participants were assured about their confidentiality. Ethical approval was obtained from concerned hospital ethical review committee.

The inclusion criteria were cases that were confirmed positive for SARS-CoV-2 through real-time reverse transcriptase PCR, both genders, Pakistani nationals, and admitted in isolation ward of Saidu group of teaching hospital Swat. The participants who had sepsis (from patients record files), co-infection (from patients record files), were below 18 years age and with missing data were excluded.

The classification of COVID-19 severity was done according to Waris *et al*[9] as ;1) Mild: very slightly symptomatic and without pneumonia; 2) Moderate: fever and symptoms of respiratory infection like cough with pneumonia; 3) Severe (having any one or more of three criteria): respiratory rate =30 times per minutes, respiratory distress; less than 93% oxygen saturation; arterial blood oxygen partial pressure (PaO2) of 300 mmHg; and 4) Critical (having any one or more of three criteria): require mechanical ventilation and respiratory failure ; shock; ICU admitted with other organ failures.

Three millilitres venous blood was obtained from all participants and sent to the pathology for haematological analysis. The blood parameters were analysed in Automatic Haematology Analyzer (USA incop). Haemoglobin (Hb), total leukocyte count (TLC), neutrophil (N), lymphocyte (L), monocyte (M), basophil and eosinophil counts were calculated.

Data analysis was done in R package version 4.1.3. Mean and SD were computed for continuous data like age and blood parameters. Frequency and percentages were calculated for qualitative data like gender and severity of COVID-19. Comparison of blood parameters was done among various severity classes of COVID-19 by running one-way ANOVA. The level of significance was $p \leq 0.05$.

RESULTS

The mean age of the participants was 50.6±6.26 years with range from 38 to 62 years. The mean haemoglobin, TLC and platelets were 14.16±2.31g/dl, 11.78±2.05 (x 10^3/µl) and 212.55±19.68(x10^3/µl) respectively. Rest of details are given in Table-1.

Males were 78 (74.29%) and females were 27(25.71%). Most of the participants had mild COVID-19 (n=60, 57.14%) followed by moderate (n=24, 22.86%). Most common age group was 51–55 years (n=30, 28.57%). (Table-2)

In critical group the mean haemoglobin was least (10.21±1.07 g/dl) and was highest in mild cases (15.76±1.16 g/dl) and these differences were highly statistically significant (p<0.001). TLC was highest in critical COVID cases (15.90±0.51x10^3/µl) followed by moderate (12.44±0.65x10^3/µl). Similarly, neutrophil count was highest in critical (89±2.1) followed by severe (86±1.12). Rest of the results are shown in table-3. The highest TLC was in critical cases followed by moderate and severe as shown in figure-1. Lowest Hb level was present in critical patients followed by severe and highest in mild COVID cases. (Figure-2)

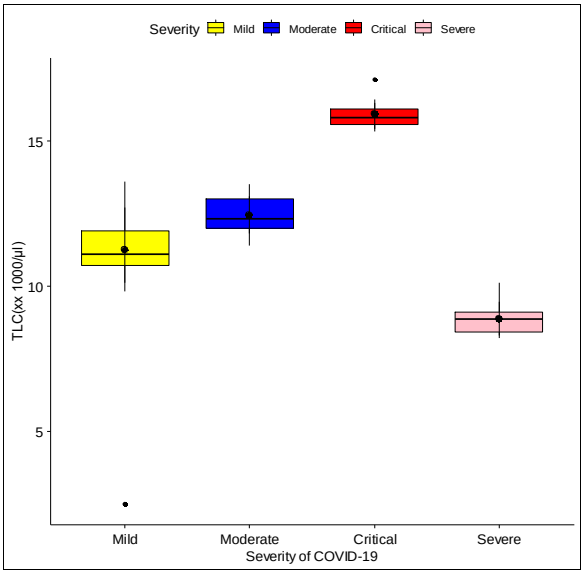

Figure-1: Total leukocyte count among various severities of COVID-19 cases

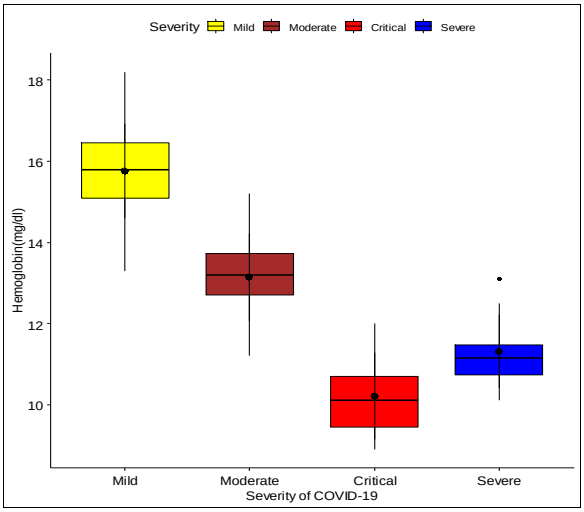

Figure-2: Haemoglobin among various severity of COVID-19 cases

Table-1: Mean of age, haemoglobin, TLC and platelets

Variable	Mean (SD)
Age (year)	50.61 (6.26)
Haemoglobin (g/dl)	14.16 (2.31)
TLC (x 10^3/µl)	11.78 (2.05)
Platelets (x 10^3/µl)	212.55 (19.68)
Neutrophil (%)	75.32 (9.90)
Lymphocyte (%)	21.10 (9.95)
Monocyte (%)	96.43 (4.16)
Eosinophil (%)	2.66 (1.33)
Basophil (%)	0 (0)

Table-2: Frequency of gender, COVID-19 severity and age group

Parameter	Characteristic	n (%)
Gender	Female	27 (25.71)
	Male	78 (74.29)
Severity of COVID-19	Mild	60 (57.14)
	Moderate	24 (22.86)
	Severe	10 (9.52)
	Critical	11 (10.48)
Age group (years)	38–45	24 (22.86)
	46–50	26 (24.76)
	51–55	30 (28.57)
	56 and above	25 (23.81)

Table-3: Comparison haematological parameter among various severity groups of COVID-19 cases

Characteristic	Critical, n= 11[1]	Mild, n= 60[1]	Moderate, n = 24[1]	Severe, n = 10[1]	*p*-value[2]
Haemoglobin	10.21 (1.07)	15.76 (1.16)	13.13 (1.08)	11.31 (0.91)	<0.001
Total leukocyte count	15.90 (0.51)	11.24 (1.44)	12.44 (0.65)	8.87 (0.57)	<0.001
Platelets	161 (7)	221 (6)	221 (6)	199 (7)	<0.001
Neutrophil	89 (2.1)	68 (5)	82 (7)	86 (1.12)	<0.001
Basophil	0 (0)	0 (0)	0 (0)	0 (0)	-
Eosinophil	5(0.77)	1.95(0.76)	2.7 (0.95)	4.2 (1.032)	<0.001
Lymphocyte	6 (2)	29 (5)	14 (2)	10 (1)	<0.001
Monocyte	95(0.77)	97.05 (2.50)	95.79± (7.68)	95.8 (1.03)	0.334

[1]Mean (SD); [2] One-way ANOVA

DISCUSSION

This study was carried out to determine the blood complete count pattern in COVID-19 positive cases and the association of these parameters with severity of COVID-19. Our study showed that there was statistically significant difference in blood parameters among various severity groups of COVID-19.

The mean age of the participants was 50.6±6.26 years in our study. This shows that COVID-19 affects later age cases. Waris *et al*.[9] reported the overall mean age was 48.94±6.1 years. These results are similar to our findings.

Our study shows that males were more than females. This show the males are more affected by COVID-19 than females. The high prevalence of COVID-19 in males than females can be due to more exposure of males in public gatherings or due to genetic factors. Previous studies on COVID-19 also reported that males were more affected than females.[7, 9]

Haemoglobin in an important component of red blood cells carrying oxygen to the all living tissues. Our findings show that as the severity of COVID-19 increases and the level of haemoglobin decreases. The least level of haemoglobin was found in critical COVID-19 cases and highest level in mild COVID-19. This low haemoglobin level can lead to hypoxia and shortness of breath.[10] Other studies also reported that level of haemoglobin is reduced in COVID-19 affected cases and its level can be a significant predictor for mortality.[9,11]

Our results showed that total leukocyte count (TLC) increases as the severity of COVID-19. The highest level of TLC (especially neutrophil) was seen in critical cases. Neutrophils are the main infantry of the body and become replicated rapidly when inflammation or infection prevails in body. Their action is phagocytic and clear microbes from the body.[12] Previous studies clearly showed that neutrophils and TLC increased during COVID-19 infection.[13,14]

Our results showed that platelet count was low in severe and critical COVID-19 cases as compared to mild. Similar results were found in previous study.[9] Another previous study also reported that 36.2% patients had thrombocytopenia.[15] The proposed mechanism of thrombocytopenia in COVID-19 cases is that coronavirus infects bone marrow and suppresses haemopoiesis.[16]

This study has some limitations like it is retrospective, small sample size, lacks control group and single centre. More studies with stringent methodology are recommended.

CONCLUSION

Within the limitations of this study, it can be concluded that there is significant decrease in mean haemoglobin and platelets and increase in TLC in patients infected from COVID-19.

AUTHORS' CONTRIBUTION

JRS: Topic conception, manuscript writing, data analysis, final drafting. AL: Data collection, literature review.

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