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ORIGINAL RESEARCH

Complete blood count alterations of covid-19 patients in a tertiary care hospital in north India

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ABSTRACT

In confirmed positive patients, the purpose of this study is to assess the relationship between Coronavirus Disease 19 (COVID-19) and the primary complete blood count (CBC) parameters. In a retrospective cross-sectional study, 192 files of patients with a confirmed diagnosis of COVID-19 who were being treated at Govt medical College &Hospital Rajouri in India were randomly chosen as a study group for haematological parameters, and an additional 192 files of patients without a confirmed diagnosis of COVID-19 whose medical histories did not include any conditions that might have an impact on their haematological profile were chosen as a control group. The control group's gender, age, and nationality were matched to those of the study group. In contrast to COVID-19 negative patients, anaemia and thrombocytopenia weresignificantly more common in COVID-19 positive patients.However, the prevalence of leukopenia did not differ statistically between the two groups, but the positive individuals were 3.4 times more likely to be anaemic and around 5.3 times more likely to be thrombocytopenic. The median values for mean cell volume (MCV), total white blood cell (WBC) count, lymphocyte count, and basophil count between the two groups, however, did not indicate any statistically significant differences. Further research is advised to corroborate these findings because severe positive individuals may have highly developed anaemia and thrombocytopenia.

Keywords: COVID-19, Complete blood count, RBCs, WBCs

INTRODUCTION

Three new coronavirus subtypes have developed in the past 20 years during epidemics that are extremely concerning on a worldwide scale. These are the Severe Acute Respiratory Syndrome Coronavirus (SARS-COV), Middle-East Respiratory Syndrome Coronavirus (MERS-CoV), and Severe Acute Respiratory Syndrome Coronavirus-2, in that order [1]. Broad commonalities can be seen in how they appear, including a tendency to escalate to severe symptoms that are frequently accompanied by high rates of morbidity and mortality. Despite this, a comparison of their clinical manifestations and consequences reveals a distinct diversity of the corresponding processes [2].

Millions of individuals worldwide are being severely affected by the dangerous COVID-19 new coronavirus, which is quickly mutating and spreading over the globe [3]. SARSCoV-2 (Respiratory Syndrome Coronavirus 2), a zoonotic positive-strand RNA virus, is the disease's culprit [4]. Serious economical and health problems have been brought on by the sickness [5, 6]. Patients who have COVID-19 symptoms typically exhibit moderate clinical symptoms when they first become ill, such as a dry cough, fever, and changes in taste or smell, and they typically bounce back within a few days [7, 8].However, patients with severe symptoms, particularly those who have coexisting conditions like chronic diseases, may quickly progress to develop pneumonia and acute respiratory distress syndrome days after the onset of the disease, with a higher mortality rate [8, 9], indicating that COVID-19 causes a multisystem disorder [10]. Since the first reports treated COVID-19 as if it were merely pneumonia, accumulating data have shown that intravascular coagulation and coagulopathy are frequent in highly infected individuals, increasing the death rate [11, 12]. These findings indicated that the coagulation pathway is very active in people with COVID-19 infection [10, 13].

Peripheral eosinophils and neutrophils were shown to be significantly altered in COVID-19 patients in a number of haematological laboratory examinations into lymphocytes, raising the intriguing possibility that they may serve as markers for both disease progression and treatment efficacy [14]. Importantly, some research also raises the possibility that haemoglobin (Hb) levels may fall as a result of COVID19 infection [15, 16]. This alleged connection to different forms of pneumonia had already been documented [17].In order to compare COVID-19 hospitalised cases in India to nonpositive cases, we performed a retrospective analysis to assess the relationship between COVID-19 and the major blood parameters, including the Hb concentration, other red blood cell (RBC) indices, TWBCs, and platelet indices.

MATERIALS AND METHODS

To compare Hb concentration, RBC counts, RBC indices, WBCs, and platelet indices between confirmed positive hospitalised cases and negative subjects, a retrospective, hospital-based, cross-sectional study was carried out at Govt medical College and Hospital Rajouri in India from January to February 2022.

As a study group for Hb, RBC counts, and red cell indices, 192 anonymous COVID-19 patients' files were chosen at random from medical records and clinical laboratory records. As a control group, 192 files matching to COVID-19-negative patients who were matched for age, gender, and country but had no prior history of blood disorders were chosen at random. A positive Reverse-Transcriptase-Polymerase-Chain-Reaction (RTPCR) SARS-CoV-2 assay result supported the diagnosis of COVID-19 [18, 19]. The COVID-19 investigation's samples were collected utilising nasopharyngeal swab swabs.

If a hospitalised positive case or a hospitalised negative case had a history of a condition that might affect the haematological profile, was taking medication that might affect the complete blood count (CBC), had liver or cardiovascular disease, or was being treated for any of these conditions, they were identified and then excluded. The institutional ethical committee gave its approval to the project.

The Statistical Package for the Social Sciences (SPSS Software version-25; IBM Corp., Armonk, NY, USA) was used to enter the laboratory results as well as the clinical and personal data that was taken from the patient files. It was then corrected and coded. According to the relevance of the test for normality, continuous data were represented and presented as mean standard deviation (SD), with the data being normally distributed. The nonnormally distributed data were applied using the median interquartile range (IQR). The Mann-Whitney U test was used for nonnormally distributed data and the independent

Student's t test was used for normally distributed data to compare continuous variables. The cut-off point for significance was chosen to be a p value of 0.05 or less.

RESULTS

In this study, the gender distribution of the COVID-19 patients and the control group revealed that 110 patients (57.2 %) and 82 (42.7 %) were female and males, respectively. The COVID-19 patient group's median age was 49 ± 23:75, whereas the non-COVID-19 patient group's median age was 45 ± 26:0, with a non-significant difference in age (p = 0:165).

Comparing COVID-19 patients and the non-COVID-19 control group's haemoglobin concentrations, RBC counts, and red cell indices is shown in Table 2. According to our findings, the median values of mean cell haemoglobin (MCH), mean RBC count, haematocrit (Hct), and mean cell haemoglobin concentration (MCHC) are all substantially lower in COVID-19 patients than in the control group ($p \leq 0:01$,$p \leq 0:01$, $p = 0:041$, and $p \leq 0:01$, respectively). When compared to the control group, the median values of the red cell distribution width (RDW) in COVID-19 patients statistically significantly increase (p 0:01). The MCV median values, however, did not indicate a significant distinction between the two groups (p = 0:264).

The median values of the eosinophil count and platelet count among COVID-19 patients were significantly lower than those of controls ($p \leq 0:01$ and $p \leq 0:01$, respectively), as shown in Table 3. Comparing COVID19 patients to the control group, the median values of Mean Platelet Volume (MPV) revealed a statistically significant rise ($p \leq 0:01$). The median results for the basophil count, lymphocyte count, and total white blood cell count, however, did not reveal a discernible difference between the two groups.

Table 1: Distribution of age and genderof the COVID-19 patients and the control group

Variables	COVID-19 patients N (%) (n=192)	Non COVID-19 patients N (%) (n=192)	P value
Gender			0.165
Males	110 (57.2)	110 (57.2)	
Females	82 (42.7)	82 (42.7)	
Age (yrs)			
18-98	49.00 ± 23.75	45.0 ± 26.0	

Table 2: Comparison of hemoglobin concentration, RBC counts, and red cell indices of the COVID-19 patient and the non-COVID-19 patient control group

Parameters	COVID-19 patients N (%) (n=192)	Non COVID-19 patients N (%) (n=192)	P value
Hb (g/dL)	11.23 ± 3.49	12.39 ± 2.43	≤0.01∗
PCV (L/L)	33.39 ± 9.33	37.89 ± 7.23	≤0.01∗
RBCs ($\times 101^2$ /L)	4.16 ± 1.28	4.44 ± 0.86	≤0.01∗
MCV (fL)	84.90 ± 9.30	85.7 ± 58.00	0.264
MCH (pg)	27.60 ± 3.70	27.70 ± 3.20	≤0.041∗
MCHC (%)	33.10 ± 1.90	32.50 ± 1.70	≤0.01∗
RDW (%)	15.34 ± 3.78	14.89 ± 2.60	≤0.01∗

Table 3: WBC and platelet indices of the COVID-19 patient and the non-COVID-19 patient control group

Parameters	COVID-19 patients N (%) (n=192)	Non COVID-19 patients N (%) (n=192)	P value
Total WBC count ($\times 10^9$ /L)	7.69 ± 4.14	7.91 ± 4.28	0.983

Neutrophil (%)	62.9 ± 20.4	61.5 ± 25.5	0.173
Lymphocyte (%)	25.1 ± 17.9	24.64 ± 21.9	0.604
Monocyte (%)	8.4±3.6	8:1±3:97	0.591
Eosinophil (%)	1.8±2.9	2.2 ± 3.2	≤0.01∗
Basophil (%)	0.6 ± 0.6	0.8 ± 0.7	0.124
Mean Platelet Volume (MPV)	9.4 ± 1.8	9.01 ± 1.8	≤0.01∗
Platelet count ($\times 10^9$/L)	249.2 ± 128.1	305.01 ± 161.0	≤0.01∗

DISCUSSION

The majority of participants in this study (110, 57.2%) were male, with a median age of 49:0 ± 23:75. In research by Usul and collaborators [20], 52.1% of the patients were male, with a median age of 47. This conclusion is consistent with other studies reporting comparable outcomes. According to Liang et al. [18], the median age of all cases was 59, and around 56% of them were male. In addition, Chen et alstudy's [19] stated that the median patient age was 41 and that 56% of the patients were men. In another study, the mean age was 61:67 15:60 and 72% of the participants were men. According to Usul et al. [20], the average age was 46:2 15:5 years, and 69.3% of the population was male. This finding may be explained by epidemiological studies' findings that men are more likely than women to contract COVID-19 because of biological variations in the immune system and genetic variables [21, 22]. Males are more contagious than females due to lifestyle factors such drinking alcohol, smoking, and a lack of commitment to social distance [18]. Additionally, according to Bwire and colleagues [21], women were behaving more responsibly toward the COVID-19 situation than men were. However, according to other scholars, the ratio of men to women was equal [23].

We discovered that COVID-19 individuals had significantly lower median values for Hb concentration, RBC count, HCT, MCH, and MCHC when compared to controls. This result is consistent with research by Yuan and colleagues [24], who discovered that patients who were severely and critically ill had considerably decreased RBC and Hb, as well as with another study [25], which reported a rapid reduction in Hb and RBC among COVID-19 patients.

Furthermore, a study by Mei et al. [26] discovered that patients with severe COVID-19 had considerably lower levels of the red blood cell parameters (RBC, Hb, and HCT). Although the precise mechanism by which COVID-19 induces anaemia is not entirely understood, it has been proposed that it does so by preventing erythropoiesis in the bone marrow. Contrarily, Hb levels were discovered to be considerably greater in COVID-19-positive patients than in COVID-19-negative individuals, according to Usul et al. [20].The discrepancies in the study population's characteristics, such as the prevalence of underlying chronic diseases and cigarette smoking, which may have a direct impact on the RBC profile, may be the cause of this disparity from our results. According to the authors' statements [20, 27], those elements were not the exclusion criteria. Most COVID-19 patients had a normal CBC upon admission to the hospital, according to Fan and his coworkers [28].

The COVID-19 patients in this study exhibit a statistically significant increase in RDW median values compared to the control group. This result is consistent with Lee and coworkers' [29] finding that nearly half (49.7%) of COVID-19 hospitalised patients had elevated RDW values at presentation, and with Wang et al[30] 's finding that the severity of COVID19 was associated with significantly higher RDW-CV and RDW-SD morphological parameters.The median values of the eosinophil count and platelet count among COVID-19 patients were significantly lower than those among controls, according to the current study. This result is consistent with earlier studies [23, 31–34]. Patients with COVID-19 frequently experience thrombocytopenia as a result of thrombopoiesis inhibition, immunological platelet destruction, and consumption brought on by lung injury [35].

CONCLUSION

Due to low Hb concentration, COVID-19 patients may experience anemia-related consequences as hypoxia and coronary and pulmonary failure. Patients with COVID-19 may also experience bleeding issues due to thrombocytopenia. Therefore, packed RBC and platelet transfusions may help to treat and prevent problems like anaemia and bleeding, which will lower the death rate from COVID-19 infection.

REFERENCES

1. J. Guarner, "Three emerging coronaviruses in two Decades," American Journal of Clinical Pathology, vol. 153, no. 4, pp. 420-421, 2020.
2. J. GergesHarb, H. A. Noureldine, G. Chedid et al., "SARS, MERS and COVID-19: clinical manifestations and organsystem complications: a mini review," Pathogens and Disease, vol. 78, no. 4, 2020.
3. M. Cascella, M. Rajnik, A. Aleem, S. Dulebohn, and R. Di Napoli, "Features, evaluation, and treatment of coronavirus (COVID-19)," StatPearls, vol. 35, no. 5, pp. 20–28, 2021.
4. A. Sharma, S. Tiwari, M. K. Deb, and J. L. Marty, "Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2): a global pandemic and treatment strategies," International Journal of Antimicrobial Agents, vol. 56, no. 2, 2020.
5. T. Singhal, "A review of coronavirus disease-2019 (COVID19)," Indian Journal of Pediatrics, vol. 87, no. 4, pp. 281–286, 2020.
6. A. Alsrhani, K. Junaid, S. Younas, S. S. M. Hamam, and H. Ejaz, "COVID-19 pandemic: through the lens of science, a painstaking review," Clinical Laboratory, vol. 66, no. 10/2020, 2020.
7. Thakar, S. Panda, P. Sakthivel et al., "Chloroquine nasal drops in asymptomatic & mild COVID-19: an exploratory randomized clinical trial," The Indian Journal of Medical Research, vol. 153, no. 1, p. 151, 2021.
8. H. Ejaz, A. Alsrhani, A. Zafar et al., "COVID-19 and comorbidities: deleterious impact on infected patients," Journal of Infection and Public Health, vol. 13, no. 12, pp. 1833–1839, 2020.
9. M. Roberts, M. Levi, M. McKee, R. Schilling, W. S. Lim, and M. P. W. Grocott, "COVID-19: a complex multisystem disorder," British Journal of Anaesthesia, vol. 125, no. 3, pp. 238– 242, 2020.
10. M. Z. Zuo, Y. G. Huang, W. H. Ma et al., "Expert recommendations for tracheal intubation in critically ill patients with noval coronavirus disease 2019," Chinese Medical Sciences Journal, vol. 35, no. 2, 2020.
11. M. Levi and T. Iba, "COVID-19 coagulopathy: is it disseminated intravascular coagulation?," Internal and Emergency Medicine, vol. 16, no. 2, pp. 309–312, 2021.
12. H. Asakura and H. Ogawa, "COVID-19-associated coagulopathy and disseminated intravascular coagulation," International Journal of Hematology, vol. 113, no. 1, pp. 45–57, 2021.
13. P. Zamboni, "COVID-19 as a vascular disease: lesson learned from imaging and blood biomarkers," Diagnostics, vol. 10, no. 7, 2020.
14. Huang, Y. Wang, X. Li et al., "Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China," The Lancet, vol. 395, no. 10223, pp. 497–506, 2020.
15. G. Lippi and C. Mattiuzzi, "Hemoglobin value may be decreased in patients with severe coronavirus disease 2019," Hematology, Transfusion and Cell Therapy, vol. 42, no. 2, pp. 116-117, 2020.
16. M. C. Reade, L. Weissfeld, D. C. Angus, J. A. Kellum, and E. B. Milbrandt, "The prevalence of anemia and its association with 90-day mortality in hospitalized community-acquired pneumonia," BMC Pulmonary Medicine, vol. 10, no. 1, 2010.

17. N. Rahimi-Levene, M. Koren-Michowitz, R. Zeidenstein, V. Peer, A. Golik, and T. Ziv-Baran, "Lower hemoglobin transfusion trigger is associated with higher mortality in patients hospitalized with pneumonia," Medicine, vol. 97, no. 12, 2018.
18. Liang, J. Cao, Z. Liu et al.,"Positive RT-PCR test results after consecutively negative results in patients with COVID-19," Infectious Diseases, vol. 52, no. 7, pp. 517–519, 2020.
19. Z. H. Chen, Y. J. Li, X. J. Wang et al., "Chest CT of COVID-19 in patients with a negative first RT-PCR test," Medicine, vol. 99, no. 26, 2020.
20. Usul, I. San, B. Bekgoz, and A. Sahin, "Role of hematological parameters in COVID-19 patients in the emergency room," Biomarkers in Medicine, vol. 14, no. 13, pp. 1207–1215, 2020.
21. M. Bwire, "Coronavirus: Why men are more vulnerable to COVID-19 than women?," SN Comprehensive Clinical Medicine, vol. 2, no. 7, pp. 874–876, 2020.
22. R. Zhong, L. Chen, Q. Zhang et al., "Which factors, smoking, drinking alcohol, betel quid chewing, or underlying diseases, are more likely to influence the severity of COVID-19?," Frontiers in Physiology, vol. 11, article 623498, 2021.
23. J. M. Jin, P. Bai, W. He et al., "Gender differences in patients with COVID-19: focus on severity and mortality," Front Public Health, vol. 8, no. 2, p. 152, 2020.
24. X. Yuan, W. Huang, B. Ye et al., "Changes of hematological and immunological parameters in COVID-19 patients," International Journal of Hematology, vol. 112, no. 4, pp. 553–559, 2020.
25. A. Berzuini, C. Bianco, A. C. Migliorini, M. Maggioni, L. Valenti, and D. Prati, "Red blood cell morphology in patients with COVID-19-related anaemia," Blood Transfusion, vol. 19, no. 1, pp. 34–36, 2021.
26. Y. Mei, S. E. Weinberg, L. Zhao et al., "Risk stratification of hospitalized COVID-19 patients through comparative studies of laboratory results within fluenza, " EClinicalMedicine , vol. 26, 2020.
27. M. Rossato and A. Di Vincenzo, "Cigarette smoking and COVID-19, " Pulmonology, vol. 27, no. 3, pp. 277-278, 2021.
28. B. E. Fan, "Hematologic parameters in patients withCOVID - 19 infection: a reply, " American Journal of Hematology , vol. 95, no. 8, 2020.
29. J. J. Lee, S. M. Montazerin, A. Jamil et al., "Association between red blood cell distribution width and mortality and severity among patients with COVID-19: a systematic review and meta-analysis, " Journal of Medical Virology, vol. 93, no. 4, pp. 2513 –2522, 2021.
30. C. Wang, R. Deng, L. Gou et al., "Preliminary study to identify severe from moderate cases of COVID-19 using combined hematology parameters, " Annals of Translational Medicine , vol. 8, no. 9, p. 593, 2020.
31. N. Chen, M. Zhou, X. Dong et al., "Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study," The Lancet, vol. 395, no. 10223, pp. 507 –513, 2020.
32. Naoum, A. L. Z. Ruiz, F. H. O. Martin, T. H. G. Brito, V. Hassem, and M. G. L. Oliveira, "Diagnostic and prognostic utility of WBC counts and cell population data in patients with COVID-19, " International Journal of Laboratory Hematology , vol. 43, no. S1, pp. 124 –128, 2021.
33. O. Pozdnyakova, N. T. Connell, E. M. Battinelli, J. M. Connors, G. Fell, and A. S. Kim, "Clinical significance of CBC and WBC morphology in the diagnosis and clinical course of COVID-19 infection, " American Journal of Clinical Pathology, vol. 155, no. 3, pp. 364 –375, 2021.

34. J. Xie, Z. Tong, X. Guan, B. Du, and H. Qiu, “Clinical characteristics of patients who died of coronavirus disease 2019 in China, ” JAMA Network Open, vol. 3, no. 4, 2020.
35. P. Xu, Q. Zhou, and J. Xu, “Mechanism of thrombocytopenia in COVID-19 patients, ” Annals of Hematology, vol. 99, no. 6, pp. 1205 –1208, 2020.