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ORIGINAL ARTICLE

Haematological measurement of the quality of life of COVID-19 patients in a Port Harcourt isolation centre

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ABSTRACT

Introduction: COVID-19 has been associated with various hematological abnormalities, including lymphopenia, thrombocytopenia, and changes in white blood cell counts, linked to disease severity and patient outcomes. Using hematological indices, this study assessed patients' quality of life in the COVID-19 centre, Port Harcourt.

Materials and Methods: A cross-sectional study was conducted involving fifty-five (55) COVID-19-positive patients and fifty-five (55) control subjects aged between twenty (20) and sixty-five (65) years at the Port Harcourt COVID-19 isolation center. Blood samples were collected from all consenting participants for haematological investigations. Key haematologic parameters were measured, including Haemoglobin (HGB), Packed Cell Volume (PCV), Total White Blood Cell count (TWBC), Granulocyte percentage, Lymphocyte percentage, Mid-cell percentage, and Platelet count. Sysmex XP-300 Automated Haematology Analyzer was used for the analysis.

Results: The findings indicated significant derangements in haematological parameters. Specifically, granulocytes, which constituted mainly of the neutrophils, are significantly increased in patients with COVID-19(51%) when compared with controls (45%) ($p = 0.02$). Lymphocytes are significantly reduced in the COVID-19 subjects (42%) when compared with the control subjects (49%)($p = 0.01$). No significant differences existed in the hemoglobin level, PCV, TWBC count, and Platelet count of the COVID-19 subjects compared to the control subjects. ($p = 0.55$), ($p = 0.19$), ($p = 0.13$) and ($p = 0.41$) respectively.

Conclusion: The study indicated relative neutrophilia and lymphopenia among COVID-19 subjects.

Keywords: COVID-19, hematologic markers, Hemoglobin, Packed Cell Volume, Total White Blood Cell count

INTRODUCTION

In early December 2019, multiple cases of pneumonia of unknown etiology were reported in Wuhan, Hubei Province, China, later identified as caused by the novel coronavirus, SARS-CoV-2(1). The rapid spread of this virus has resulted in a global pandemic, underscoring the urgent need to understand its effects on various physiological systems, particularly the hematological parameters that play a crucial role in inflammation, immune responses, hemostasis, and oncogenesis.

Hematological markers, including Hemoglobin (HGB), Packed Cell Volume (PCV), Total White Blood Cell count (TWBC), and the differential counts of Granulocytes and Lymphocytes, are vital in assessing the body's response to infection. Observational studies have identified the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) as inflammatory markers that may serve as valuable prognostic indicators in various diseases, including COVID-19 (2,3). Notably, research indicates that severe COVID-19 patients tend to exhibit elevated NLR, suggesting a hyper-inflammatory state that correlates with adverse outcomes (4,5).

Moreover, endothelial injury induced by SARS-CoV-2 infection can release pro-inflammatory cytokines such as IL-1, IL-6, and TNF-α, contributing to a hyper-inflammatory state that may precipitate thrombotic events (6,7). Elevated D-dimer levels and persistent abnormalities in hematological parameters, including PLT, have been linked to poor prognosis in COVID-19 patients (8).

Given the critical role of hematological markers in understanding the disease progression and potential complications of COVID-19, this study aims to evaluate the specified hematological parameters—HGB, PCV, TWBC, Granulocyte percentage, Lymphocyte percentage, Mid-cell percentage, and PLT—in COVID-19 patients. This evaluation will focus on their prognostic significance and potential as biomarkers for early diagnosis and timely intervention.

This research is particularly crucial as physicians and the World Health Organization actively seek data from diverse global regions to understand the pathogenicity and pathophysiology of COVID-19, which is essential for controlling the virus's spread and providing effective treatment to infected individuals. In Port Harcourt, the determination of these markers is vital for uncovering the underlying causes of mortality associated with COVID-19, as the current understanding of the high death rates remains insufficient. Furthermore, there is a significant lack of data regarding hematologic markers in COVID-19 patients in this region(9). This study aims to fill this gap, providing essential reference points for understanding the susceptibility and resistance mechanisms linked to these markers and their impact on disease progression, severity, and associated complications in COVID-19 patients.

MATERIALS AND METHODS

Study Design

A cross-sectional study was employed to evaluate haematologic indices in COVID-19 patients in Port-Harcourt City Isolation centres to understand the effect of COVID-19 on haematological parameters.

Eligibility Criteria

Inclusion Criteria

Subjects (males or females) who tested positive for COVID-19, confirmed the disease, and are currently at the isolation center were included in the study. Those who tested negative for the disease were recruited for the study as control subjects.

Exclusion Criteria

On the other hand, unconscious subjects

or those experiencing severe difficulty in breathing as a result of COVID-19 were excluded from the study as obtaining consent from them was complex.

Study Population

The population of interest was those infected with coronavirus without gender restrictions. Between the ages of twenty (20) and sixty-five (65), fifty-five (55) COVID-19 positive subjects and fifty-five (55) control subjects were recruited for this study.

Ethical Consideration

The design of this study was approved by the Ethical Committee of the Rivers State Ministry of Health before it began. Also, written consent was obtained from the participants before their enrollment in the study.

Sampling Method

The population of interest was randomly selected via a simple random sampling technique. All interested participants were given equal opportunities to be chosen. They were given a list of numbers, with equal numbers of even and odd numbers. All those who picked even numbers were recruited, while those who picked odd numbers were excluded.

Sample Collection

A 10 ml whole blood sample was collected from each subject using sterile hypodermic syringes and needles via the standard venipuncture technique. To analyze hematological parameters (complete blood count), 2.5 ml of the blood sample was dispensed into tripotassium EDTA anticoagulant bottles. The blood dispensed into the anticoagulant bottles was mixed adequately with the anticoagulant by gentle inversions before proceeding for analysis.

Sample Analysis

Analysis of haematology parameters was performed using an automated haematology analyzer in the samples collected in the EDTA anticoagulant (10).

Statistical Analysis

Data analysis involved descriptive statistics summarizing the data generally and by sex and age subgroups, presenting means and standard deviations. A T-test was used to compare hematological parameters between COVID-19 positive and negative subjects. Analysis of Variance (ANOVA) also examined the effects of interaction between COVID-19 test outcomes and demographic characteristics.

RESULT

Table 1: Comparison of Mean and Standard Deviation of some Haematological Parameters in Patients with COVID-19 Infection and Control Subjects

Group	N	Mean	SD	Df	T	P	Remarks
HGB (g/dL)							
Test	55	13.06	2.22	80	0.60	0.55	NS
Control	55	12.78	1.96				
PCV (%)							
Test	55	47.00	8.00	80	1.33	0.19	NS
Control	55	45.00	7.00				

TWBC (x10^9/L)							
Test	55	6.55	3.16	80	1.53	0.13	NS
Control	55	5.74	1.25				
Granulocytes (%)							
Test	55	51.00	14.00	80	2.35	0.02	SS
Control	55	45.00	9.00				
Lymphocytes (%)							
Test	55	42.00	16.00	80	2.71	0.01	SS
Control	55	49.00	9.00				
MID (%)							
Test	55	8.00	3.00	80	3.15	0.00	SS
Control	55	6.00	2.00				
PLT (x10^9/L)							
Test	55	234.00	71.00	80	0.83	0.41	NS
Control	55	246.00	66.00				

NSS: Non-statistically significant; SS: Statistically significant

The results in Table 1 above showed that the parameters with significant differences in their levels between the test group and control groups were granulocyte (%), lymphocyte (%), and mid (%), with p-values of 0.02, 0.01, and 0.00, respectively.

DISCUSSION

The results of this study illustrate hematological manifestations and their correlation with the severity of the disease in COVID-19 patients. The hematological findings in COVID-19 patients yield critical insights into the disease's pathophysiology and potential management strategies.

The variables that showed significant comparisons among the haematological parameters in patients with COVID-19 infection and healthy subjects are granulocytes, lymphocytes and MID cells. For the haematological parameters, haemoglobin, packed cell volume, total white blood cells, granulocytes and MID cells were significantly higher in the COVID-19 cases than healthy subjects. Haemoglobin levels, which is also a function of the packed cell volume, in COVID-19 positive subjects were significantly higher than in COVID-19-negative patients. While no significant difference was observed among comparative groups regarding haemoglobin, higher haemoglobin levels were seen in COVID-19 positive patients. It is possible that these results are also affected by other reasons, such as the presence of comorbidities or anaemia, and habits such as cigarette smoking. The subjects used for this study did not include a detailed patient history, and thus, their effect on haemoglobin levels were not accounted for. Hence, a key limitation in this study is that patient histories, including comorbidities or personal habits (e.g., cigarette smoking and alcohol use), were not sufficiently obtained from the patient files,

meaning their effects on the results were not accounted for.

Despite the relative stability of hemoglobin and packed cell volume levels in COVID-19 patients compared to controls, continuous monitoring remains crucial. These parameters are vital for assessing oxygen-carrying capacity, especially as respiratory compromise becomes a significant concern in infected individuals. Anemia and dehydration could complicate patient management, necessitating timely interventions to maintain optimal hematological status (13).

The observed increase in MID (monocyte and eosinophil) cell percentages suggests alterations in myeloid cell dynamics, indicative of chronic inflammation and immune modulation. Elevated MID levels may reflect a shift in the immune response toward a state of persistent inflammation, potentially exacerbating disease severity. This phenomenon aligns with the understanding that COVID-19 can induce a hyper-inflammatory state, often requiring therapeutic strategies to modulate this response (14). Although the trends in platelet counts did not reach statistical significance, they merit close observation. Platelets are multifaceted players in inflammation and coagulation, and changes in their counts can signal an acute phase response to infection. COVID-19 has been associated with thrombotic complications, underscoring the need for ongoing evaluation of platelet dynamics to mitigate risks of coagulopathy (15).

The implications of the hematological findings in COVID-19 patients underline the intricate interplay between immune responses and disease severity. The dynamics of granulocytes and lymphocytes reflect the current state of the immune system and offer valuable insights into potential therapeutic targets. Understanding these hematological changes can enhance clinical decision-making and improve patient care throughout COVID-19.

CONCLUSION

The study concluded that mild relative neutrophilia and lymphopenia constitute complications in COVID-19 patients and can potentially affect their quality of life. Thus, appropriate management can be planned for such patients.

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