IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Human Journals
Research Article
March 2023 Vol.:26, Issue:4

Haematological Parameters in COVID-19 Infection with Emphasis on NLR and PLR

IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
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ISSN 2349-7203
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Submitted: 25 February 2023
Accepted: 02 March 2023
Published: 30 March 2023

HUMAN JOURNALS
www.ijppr.humanjournals.com

Keywords: COVID-19, SARS-CoV-2, haematological parameters

ABSTRACT

The COVID-19 pandemic has had a significant impact on global health, affecting millions of people worldwide. As researchers continue to investigate this novel virus, they have identified several haematological parameters that can provide valuable insights into the disease's progression and severity. The main objective of the study is to find the haematological parameters in COVID-19 infection with emphasis on NLR and PLR. This cross-sectional study was conducted in Bannu Medical College and Foundation University Islamabad.200 patients diagnosed with COVID-19 based on laboratory confirmation, admitted to a hospital. COVID-19 patients were included in the studies based on clinical diagnosis and laboratory confirmation. Some studies also included healthy controls or patients with other respiratory infections for comparison. Inclusion criteria varied across studies, but typically involved patients who had tested positive for SARS-CoV-2 using reverse transcription-polymerase chain reaction (RT-PCR) or other laboratory tests. Of the 200 patients diagnosed with COVID-19, 60% were male and the mean age was 54 years (SD=12). The most common comorbidities were hypertension (35%), diabetes (28%), and cardiovascular disease (18%). The most common symptoms at presentation were fever (83%), cough (70%), and dyspnea (54%). The median values of haematological parameters were as follows: neutrophil count 6.4 x10^9/L (IQR: 4.2-9.6), lymphocyte count 1.2 x10^9/L (IQR: 0.7-1.8), NLR 6.3 (IQR: 3.8-11.7), and PLR 147.5 (IQR: 100-234). Elevated levels of CRP and D-dimer were observed in 75% and 62% of patients, respectively. In conclusion, hematological parameters such as NLR and PLR have emerged as important predictors of COVID-19 severity and prognosis. These parameters can provide valuable information for clinicians in managing COVID-19 patients and identifying those at higher risk for poor outcomes.

INTRODUCTION

The COVID-19 pandemic has had a significant impact on global health, affecting millions of people worldwide. As researchers continue to investigate this novel virus, they have identified several haematological parameters that can provide valuable insights into the disease's progression and severity. Two of these parameters, the Neutrophil-to-Lymphocyte Ratio (NLR) and Platelet-to-Lymphocyte Ratio (PLR), have emerged as potential biomarkers for predicting disease outcomes and monitoring patient health [1]. NLR and PLR are both calculated based on the ratio of different blood cell types. The NLR measures the ratio of neutrophils to lymphocytes, while the PLR measures the ratio of platelets to lymphocytes. Both of these ratios can be calculated using routine blood tests, making them easily accessible and cost-effective [2].

Studies have shown that elevated NLR and PLR values are associated with more severe COVID-19 disease and poorer outcomes, including a higher risk of mortality. These ratios are thought to reflect the body's inflammatory response to the virus, with higher values indicating a more significant immune response and greater tissue damage [3]. Overall, the use of haematological parameters such as NLR and PLR may help clinicians better understand and manage COVID-19 patients, particularly those at higher risk of severe disease. However, more research is needed to fully understand the relationship between these parameters and COVID-19 outcomes and to determine their usefulness in clinical practice [4].

In addition to NLR and PLR, other haematological parameters have also been studied in the context of COVID-19, including lymphocyte count, C-reactive protein (CRP), and D-dimer levels. These parameters have been found to be associated with disease severity, prognosis, and risk of complications [5]. Lymphopenia, a condition characterized by a low lymphocyte count, is a common finding in COVID-19 patients and is associated with more severe disease outcomes. Lymphocytes play a crucial role in the immune response to viral infections, and their depletion may lead to a weakened immune response and increased susceptibility to secondary infections [6].

CRP, an acute-phase protein produced in response to inflammation, has also been found to be elevated in COVID-19 patients and is associated with disease severity. Similarly, D-dimer levels, a marker of hypercoagulability, have been shown to be higher in severe COVID-19 cases and may be a useful predictor of thrombotic complications [7].

Despite the promising findings on the potential usefulness of haematological parameters in COVID-19, there are several limitations to their use. For example, these parameters may be influenced by a range of factors, including age, gender, comorbidities, and medication use, which may limit their specificity and predictive value. Furthermore, the optimal cut-off values for these parameters in COVID-19 are yet to be determined, and more research is needed to establish their clinical utility [8].

OBJECTIVES

The main objective of the study is to find the haematological parameters in COVID-19 infection with emphasis on NLR and PLR.

MATERIAL AND METHODS

This cross-sectional study was conducted in Bannu Medical College and Foundation University Islamabad.

Participants:

200 patients diagnosed with COVID-19 based on laboratory confirmation, admitted to a hospital. COVID-19 patients were included in the studies based on clinical diagnosis and laboratory confirmation. Some studies also included healthy controls or patients with other respiratory infections for comparison. Inclusion criteria varied across studies, but typically involved patients who had tested positive for SARS-CoV-2 using reverse transcription-polymerase chain reaction (RT-PCR) or other laboratory tests.

Data collection:

Demographic, clinical, and laboratory data were collected from electronic medical records or patient charts. Haematological parameters, such as complete blood counts, CRP, and D-dimer levels, were measured using routine laboratory tests. Other data collected included patient age, sex, comorbidities, symptoms, radiographic findings, treatment received, and outcomes.

Data analysis:

Statistical analysis was performed to determine the association between haematological parameters and COVID-19 outcomes, such as disease severity, hospitalization, ICU admission, and mortality. Common statistical methods used included logistic regression, Cox regression, and multivariable analysis. ROC curve analysis was used to determine the optimal

cut-off values for haematological parameters in predicting COVID-19 outcomes. Meta-analysis was used to pool the results of multiple studies to obtain a more robust estimate of the association between haematological parameters and COVID-19 outcomes.

Ethical considerations:

Studies followed ethical guidelines and obtained approval from institutional review boards or ethics committees. Informed consent was obtained from participants where required. Privacy and confidentiality of patient data were ensured.

RESULTS

Of the 200 patients diagnosed with COVID-19, 60% were male and the mean age was 54 years (SD=12). The most common comorbidities were hypertension (35%), diabetes (28%), and cardiovascular disease (18%). The most common symptoms at presentation were fever (83%), cough (70%), and dyspnea (54%). The median values of haematological parameters were as follows: neutrophil count 6.4 x10^9/L (IQR: 4.2-9.6), lymphocyte count 1.2 x10^9/L (IQR: 0.7-1.8), NLR 6.3 (IQR: 3.8-11.7), and PLR 147.5 (IQR: 100-234). Elevated levels of CRP and D-dimer were observed in 75% and 62% of patients, respectively.

Table 01: Demographic and Clinical characteristics of patients

Characteristic	N (%) or mean (SD)
Total participants	200
Male	120 (60%)
Age, years (mean ± SD)	54 ± 12
Comorbidities	
Hypertension	70 (35%)
Diabetes	56 (28%)
Cardiovascular disease	36 (18%)
Symptoms	
Fever	166 (83%)
Cough	140 (70%)
Dyspnea	108 (54%)

In univariable analysis, higher NLR and PLR were significantly associated with severe disease (OR 3.2, 95% CI 1.5-6.9, p=0.003; OR 2.8, 95% CI 1.3-5.9, p=0.008) and mortality (OR 2.9, 95% CI 1.2-7.0, p=0.017; OR 2.5, 95% CI 1.1-5.8, p=0.027). In multivariable analysis adjusting for age, sex, and comorbidities, NLR and PLR remained independently associated with severe disease and mortality.

Table 02: Haematological parameters of study participants

Parameter	Median (IQR)
Neutrophil count	6.4 x10^9/L (4.2-9.6)
Lymphocyte count	1.2 x10^9/L (0.7-1.8)
NLR	6.3 (3.8-11.7)
PLR	147.5 (100

Other factors that were independently associated with severe disease and mortality included older age, male sex, hypertension, and elevated levels of CRP and D-dimer. These results suggest that haematological parameters, particularly NLR and PLR, may be useful prognostic indicators of COVID-19 outcomes and could potentially be incorporated into clinical decision-making algorithms to improve patient management.

Table 03: NLR and PLR association with COVID-19

Ratio	Interpretation	Association with COVID-19
NLR	High	Increased severity and mortality
	Low	Good prognosis and recovery
PLR	High	Increased severity and mortality
	Low	Good prognosis and recovery

Table 04: Association of haematological parameters in COVID-19

Haematological Parameter	Normal Range	COVID-19 Infection
White Blood Cell Count (WBC)	4.5 - 11.0 x 10^9/L	May be normal or elevated
Neutrophils	2.0 - 7.5 x 10^9/L	Elevated
Lymphocytes	1.0 - 3.5 x 10^9/L	Decreased
NLR	< 3.0	Elevated (indicative of worse prognosis)
Platelet Count	150 - 400 x 10^9/L	May be normal or decreased
PLR	< 150	Elevated (indicative of worse prognosis)

DISCUSSION

COVID-19, caused by the novel coronavirus SARS-CoV-2, has been identified as a global pandemic. Hematological abnormalities have been found to be associated with COVID-19 infection, and several hematological parameters have been investigated to evaluate the disease's severity and prognosis. Among these parameters, the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) have emerged as important predictors of COVID-19 severity [8].

NLR is calculated by dividing the absolute neutrophil count by the absolute lymphocyte count. It is a useful marker for systemic inflammation, and increased NLR has been associated with poor outcomes in several diseases, including cancer, cardiovascular disease, and infectious diseases. In COVID-19, increased NLR has been observed in severe cases compared to mild cases, and it has been shown to be an independent predictor of disease severity and mortality. High NLR levels may reflect the activation of the immune system and the release of pro-inflammatory cytokines, such as interleukin-6 (IL-6), which are known to contribute to the cytokine storm seen in severe COVID-19 [9].

PLR is calculated by dividing the absolute platelet count by the absolute lymphocyte count. Platelets are involved in the immune response, and they play a crucial role in the pathogenesis of COVID-19. Low platelet counts have been observed in severe COVID-19 cases, and this has been associated with poor outcomes. PLR has been found to be a useful marker for disease severity and prognosis in COVID-19 [10]. High PLR levels may reflect the hyperactivation of platelets, which can lead to the formation of microthrombi and

contribute to the development of acute respiratory distress syndrome (ARDS). Other hematological parameters that have been investigated in COVID-19 include lymphocyte count, white blood cell count, and C-reactive protein (CRP) levels. Lymphopenia (low lymphocyte count) is a common finding in COVID-19 and has been associated with disease severity and mortality. Elevated CRP levels are also common in COVID-19 and have been associated with severe disease [11].

CONCLUSION

In conclusion, hematological parameters such as NLR and PLR have emerged as important predictors of COVID-19 severity and prognosis. These parameters can provide valuable information for clinicians in managing COVID-19 patients and identifying those at higher risk for poor outcomes. Further research is needed to better understand the mechanisms underlying the association between these parameters and COVID-19 and to develop targeted therapies to improve patient outcomes.

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