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Research Article

Evaluation of Haematological Parameters in Adult Symptomatic COVID-19 Patients in a North Indian Tertiary Care Hospital

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A B S T R A C T

Background: COVID-19 (SARS-CoV-2) often causes characteristic changes in blood counts (e.g., lymphopenia, neutrophilia, thrombocytopenia) that correlate with disease severity.[1] Routine complete blood counts (CBC) are inexpensive and widely available; understanding their patterns in COVID-19 can aid patient assessment. This study evaluated haematological parameters in adult symptomatic COVID-19 patients admitted to Era Hospital.

Methods: We performed a retrospective analysis of 1500 COVID-19 patients (≥18 years) admitted between April 2020 and October 2021. Demographic and haematological data (CBC with indices) at admission were collected. Measurable variables are reported as mean ± SD, and descriptive data as numbers and proportions. Key parameters (haemoglobin, WBC, differential counts, RBC indices, platelet count, and derived ratios) were analysed.

Results: The mean patient age was 46.5±16.4 years. Table 1 summarises mean haematology values. On admission, 52.6% of patients had haemoglobin below the normal range (anaemia) and 19.5% had thrombocytopenia (Table 2). The average total leukocyte count was 7941.7±5068.8/µL; 16.5% had leukocytosis and 4.2% had leukopenia. Neutrophil percentages averaged 70.2±14.5%, with 45.5% of patients showing neutrophilia, while lymphocytes averaged 24.5±13.0%, with 31.9% of patients demonstrating lymphopenia. The mean neutrophil-to-lymphocyte ratio (NLR) was 6.09±9.45. Other parameters (mean RBC 4.33×10^6/µL, mean HCT 37.7%) are shown in Table 1. Detailed proportions of abnormalities are given in Table 2.

Conclusion: In this large cohort, over half of symptomatic COVID-19 patients were anaemic and nearly one-third had lymphopenia on admission. Neutrophilia and elevated NLR were also common, reflecting systemic inflammation. These findings are in line with reports that blood count abnormalities such as reduced lymphocytes and low platelet count, and elevated NLR are frequent in COVID-19 and are more pronounced in severe cases.[1,2,5] Routine haematological parameters may thus provide useful, low-cost insights into disease status, though further studies correlating these findings with clinical outcomes are needed.

Keywords: COVID-19; haematology; lymphopenia; neutrophil-to-lymphocyte ratio; thrombocytopenia; blood counts

Introduction

COVID-19 (caused by SARS-CoV-2) widely known to affect the respiratory tract, but its systemic effects, including haematological abnormalities, are increasingly being acknowledged. Several clinical and laboratory studies have consistently demonstrated that COVID-19 can lead to notable alterations in blood parameters, particularly in patients with severe disease presentations. Frequently reported blood abnormalities in COVID-19 cases include reduced lymphocyte and platelet counts, along with raised acute phase reactants like D-dimer and CRP. These deranged values have been found to be more pronounced in critically ill individuals, often correlating with worse clinical outcomes and increased risk of mortality.[1, 5]

For instance, in a review article it is highlighted that "common haematological Derangements in COVID-19 are low lymphocyte count, low platelet count and increased D-dimer levels", particularly in patients with severe or progressive forms of the illness.[1] In addition to individual blood cell counts, certain parameters derived from complete blood count (CBC), like NLR, has a role in prognosis.

An increased neutrophil-to-lymphocyte ratio (NLR) and elevated total leukocyte count have been linked to more severe forms of COVID-19, reflecting greater systemic inflammation and a higher risk of adverse outcomes.[2,5]

Because complete blood count (CBC) testing is widely accessible, affordable, and routinely performed, assessing these haematological indicators can serve as a practical approach to identify patients at risk for clinical deterioration. This becomes particularly important in settings with limited healthcare resources, where Early risk stratification is crucial for efficient patient management.

With this background, the current study was designed to evaluate haematological patterns in adult patients presenting with symptoms of COVID-19 and confirmed by laboratory testing, and were hospitalised in Era Medical College.

The investigation focused on identifying the prevalence of conditions such as anaemia and abnormalities in white blood cell and platelet counts, as well as examining prognostic markers like NLR, to enhance understanding of blood-related changes in this patient group

Materials and Methods

Research methodology and background

The study was structured as a cohort study and was conducted in the Department of Pathology, Era's Lucknow Medical College and Hospital, a tertiary care teaching hospital serving urban and rural populations in North India.

Participants

Participants of the study were hospitalised patients aged ≥18 years with symptoms of COVID-19 infection, confirmed with RT-PCR, admitted between April 2020 and October 2021. Patients with pre-existing haematological disorders, malignancies, pregnant/lactating females, or those receiving chemotherapy were excluded.

Data Collection and Laboratory Testing

Patients' data, including clinical and laboratory results, were obtained retrosectively from the electronic health record system of the hospital. Blood samples were drawn into EDTA tubes and analysed using the Sysmex XS-800i automated haematology analyser. The haematological parameters assessed included complete blood count (CBC), which includes Hb, RBC, WBC, platelet, differential count, MCV, MCHC, MCH). The neutrophil-to-lymphocyte ratio (NLR) was derived from CBC. Each parameter was interpreted in relation to standard reference ranges. The number and percentage of patients falling below, within, or above the normal range for each parameter were recorded. Quantitative variables were reported as averages with root mean square deviation, while discrete variables were expressed as occurrences and proportions.

Data Analysis

Data were collected using Microsoft Excel and analysed with the help of SPSS version 16.0. Descriptive statistics included means ± standard deviation (SD) for continuous variables and frequencies for categorical variables. Comparisons were made using unpaired t-tests or ANOVA for continuous variables and chi-square tests for categorical variables. A p-value < 0.05 was considered statistically significant.

Results

Baseline Characteristics

The study comprised of 1500, symptomatic adult patients with an average age of 46.5+_16.4.

Haematological Parameters

In this study 1500 symptomatic participants of age between 18 and 91 years were considered, having an average age of 46.5±16.4 years. Table 1 presents the mean (SD) values of key haematological parameters on admission. The mean haemoglobin was 12.53±2.23 g/dL, and the mean total leukocyte count was 7941.7±5068.8/µL. Differential counts showed a mean neutrophil percentage of 70.22±14.54% and lymphocyte percentage of 24.52±13.05%. Other values included mean platelet count 194.5±81.68×10^3/µL, RBC count 4.33±0.82×10^6/µL, HCT 37.65±6.41%, MCV 87.83±9.15 fL, MCH 29.49±8.58 pg, and MCHC 33.24±2.48 g/dL.

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Table 1 summarizes the mean values of hematological parameters. Hemoglobin averaged 12.53±2.23 g/dL, TLC 7941.7±5068.8/µL, neutrophils 70.22±14.54%, lymphocytes 24.52±13.05%, platelet count 194.5±81.7×10^3/µL. NLR averaged 6.09±9.45.

Table 2 summarises the distribution of values relative to reference ranges. Notably, 52.6% of patients were anaemic (low Hb) at admission. Leukopenia (TLC below normal) was seen in 4.2%, while 16.5% had leukocytosis. Neutrophilia (neutrophils above normal) occurred in 45.5% of patients, whereas neutropenia was rare (5.8%). Lymphopenia (lymphocytes below normal) was observed in 31.9% of cases. Thrombocytopenia (platelets below normal) was present in 19.5%, with only 1.7% having thrombocytosis. Eosinophil counts were normal in most patients (81.2%), with eosinopenia in 2.8%. Monocyte percentages were within the normal range for all patients. The mean neutrophil-to-lymphocyte ratio (NLR) was 6.09±9.45 (median 2.80).

(Table 2 provides breakdowns by normal range categories.)

Table 1.Hematological parameters (mean ± SD)

Parameter	Mean ± SD
Hemoglobin (g/dL)	12.53 ± 2.23
TLC (/µL)	7941.7 ± 5068.8
Neutrophils (%)	70.22 ± 14.54
Lymphocytes (%)	24.52 ± 13.05
Platelets (×10^3/µL)	194.5 ± 81.68
RBC count (×10^6/µL)	4.33 ± 0.82
Hematocrit (%)	37.65 ± 6.41
MCV (fL)	87.83 ± 9.15
MCH (pg)	29.49 ± 8.58
MCHC (g/dL)	33.24 ± 2.48
NLR	6.09 ± 9.45

Table 2.Prevalence of hematological abnormalities (%)

Parameter	Below Normal	Normal	Above Normal
Hemoglobin	52.6	47.4	-
TLC	4.2	79.3	16.5
Neutrophils	5.8	48.7	45.5
Lymphocytes	31.9	60.3	7.8
Platelets	19.5	78.8	1.7
Eosinophils	2.8	81.2	16.0
Monocytes	-	100.0	-
RBC count	30.3% (455)	67.9% (1018)	1.8% (27)
Hematocrit	46.7% (701)	53.0% (795)	0.3% (4)

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Distribution of Abnormalities

1. Anaemia (Hb below normal) was found in 52.6% of patients.
2. Leukocytosis in 16.5%, leukopenia in 4.2%
3. Neutrophilia in 45.5%, lymphocytopenia in 31.9%
4. Thrombocytopenia in 19.5%, thrombocytosis in 1.7%

Discussion

Our analysis of 1,500 symptomatic adult COVID-19 patients revealed a mean age in the mid-40s, aligning with previous studies conducted in various Indian cohorts.[3] This demographic trend suggests that middle-aged adults constituted a substantial proportion of symptomatic cases during the study period, underscoring the vulnerability of this age group in the Indian context.

One of the most striking findings in our cohort was the high prevalence of anaemia, observed in 52.6% of patients at admission. This rate is noteworthy and may reflect underlying nutritional deficiencies common in the Indian population, including iron, vitamin B12, or folate deficiency. Additionally, chronic conditions such as renal disease or undiagnosed malignancies—both of which can contribute to

Anemia may be more prevalent in this setting. While anaemia itself is not unique to COVID-19, its high incidence among our patients highlights a potential comorbidity that may influence disease progression or complicate management.

This warrants further investigation through prospective studies assessing anaemia's impact on COVID-19 outcomes.

Although total leukocyte counts were largely within normal limits in most patients, Differential counts painted a clearer picture of the immune response. Neutrophilia was observed in 45.5% of cases, while 31.9% exhibited lymphopenia. The

The presence of lymphopenia is a well-documented haematological hallmark of COVID-19 and is often attributed to direct viral cytotoxicity, lymphocyte apoptosis, or redistribution of lymphocytes to infected tissues.[1,4]

Our lymphopenia rate, while significant, was lower than rates exceeding 60% reported in early studies from China.[4] These discrepancies may stem from differences in population genetics,viral variants, healthcare-seeking behaviour, or thresholds used to define lymphopenia. Nevertheless, the presence of lymphopenia in nearly one-third of our patients reinforces its relevance in the clinical course of the disease.

The mean neutrophil-to-lymphocyte ratio (NLR) in our cohort was 6.09, a value indicative of systemic inflammation and immune dysregulation. Elevated NLR has emerged as a reliable prognostic marker in COVID-19, correlating with disease severity, risk of ICU admission, and mortality.[2,5]

For example, Krishnan et al.identified elevated NLR as a strong predictor of severe disease and adverse outcomes.[2] Our findings of frequent neutrophilia, coupled with a raised NLR, further support the role of innate immune activation and inflammatory stress in symptomatic COVID-19 cases.

Routine evaluation of NLR may thus serve as a useful adjunct for early risk stratification.

Eosinophil counts in our study largely remained within normal limits, with Eosinopenia was observed in only a small subset of patients. This differs from several other studies that have reported a higher incidence of eosinopenia among individuals with COVID-19.[6] Such discrepancies may be attributed to variations in reference ranges, timing of sample collection, or differences in ethnicity and geography among study populations. While eosinopenia has been discussed as a potential marker in COVID-19, its inconsistent presence in our cohort suggests it may not serve as a universally reliable indicator.

Several limitations of this study must be acknowledged. Due to its retrospective nature, we were unable to categorise patients according to disease severity or clinical outcomes. Additionally, no information was uniformly available on key acute phase reactants such as D-dimer, C-reactive protein (CRP), ferritin, limiting our ability to evaluate correlations between haematological findings and biochemical markers of inflammation or prognosis. Nevertheless, the large sample size provides a comprehensive snapshot of common haematological changes in study patients treated at Era Hospital.

To summarise, our results highlight the relevance of standard complete blood count (CBC) parameters—particularly haemoglobin concentration, leukocyte

differentials, and NLR—as practical indicators of systemic involvement in COVID-19. Further longitudinal studies should be done to establish their prognostic utility in assessing disease severity and outcomes, as well as to better understand the underlying mechanisms driving these haematological changes across different populations.

Conclusion

In summary, adult symptomatic COVID-19 patients in this tertiary care center commonly exhibited anaemia, neutrophilia, and lymphopenia on admission. Over half were anaemic, one-third had lymphopenia, and many showed elevated NLR—indicative of systemic inflammation. These routine haematological abnormalities, consistent with previous reports.[1,2,6] may serve as accessible prognostic markers. Given the ubiquity of CBC testing, these parameters could aid early identification of high-risk patients. Further research linking CBC findings with clinical outcomes is warranted.

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