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ORIGINAL ARTICLE

White blood count and inflammatory markers in the patients with COVID-19 infection and severity of illness.

Namra Mahmood[1], Zahra Riaz[2], Hira Tariq[3], Fatima Altaf[4], Arooj Sattar[5], Sadia Ijaz[6], Asma Saadia[7]

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ABSTRACT… Objective: To assess whether hematological and inflammatory parameters can be useful in assessing severity of disease and predict mortality in patients with COVID-19. **Study Design:** Cross Sectional Comparative Retrospective. **Setting:** COVID ward and ICU, Central Park Teaching Hospital Lahore. **Period:** 23rd April 2021 to 23rd June 2021. **Material & Methods:** The study population was selected by convenient sampling and all patients admitted to the COVID ward and ICU during this time span of two months with positive COVID PCR were included in the study. **Results:** Among the study population 29(58%) were males while 21(42%) were females with male to female ratio of 1.38:1 and the difference was not found to be statistically significant. The mean age of the patients was 65.2±08 years. The complete blood parameters-white blood count, absolute neutrophil count, lymphocyte count and neutrophil lymphocyte ratio were compared between groups and it was found that white blood count, absolute neutrophil count and neutrophil lymphocyte ratio was significantly different between different groups. Inflammatory markers like IL-6, ferritin, C-reative protein and d-dimers were also assessed in different severity groups and all were found to be significantly high in severe/critical group. **Conclusion:** It is concluded that simple inexpensive parameters like white blood count, neutrophil lymphocyte ratio and neutrophil count can be used to evaluate the severity of disease and to predict those patients who are at increased risk of mortality. In the similar way inflammatory markers like C-reactive protein, D-dimers, IL-6 and ferritin can be used to group the disease severity and also to monitor the disease.

Key words: Neutrophil Lymphocyte Ratio, COVID-19, Inflammatory Markers, D-dimers, IL-6.

INTRODUCTION

More than million people are affected worldwide by corona virus and rapidly evolved as global pandemic causing acute respiratory distress syndrome.[1] It is caused by an enveloped RNA virus of coronaviridae family. The usual route of spread is direct transmission through respiratory droplet infection, salivary secretions and from contaminated things causing indirect transmission.[2] Studies have shown that COVID-19 is a multisystem disease and affect cardiovascular, gastrointestinal, neurological, hematopoietic and immune system.[3]

Several studies conducted locally and internationally have shown that simple parameters like complete blood count and biochemical parameters can predict the mortality and severity of disease in patients with COVID-19 infection.[3] A study conducted by Taj et al. in Lahore has shown that white blood count, absolute neutrophil count, neutrophil lymphocyte ratio, D-dimers and ferritin are significantly raised in patients with critical disease. Another study conducted at Sahiwal teaching hospital has shown that white blood count, absolute neutrophil count, neutrophil lymphocyte ratio, platelet lymphocyte ratio, IL-6, C-reactive protein, ALT, AST and APTT were significantly high in COVID-19 patients compared to healthy controls.[4]

A study conducted in Saudi Arabia studied complete blood count changes in patients with COVID-19 and showed that anemia and

1. MBBS, M.Phil (Hematology), Assistant Professor Pathology, Central Park Medical College, Lahore.
2. MBBS, M.Phil (Chemical Pathology), Assistant Professor Pathology, Central Park Medical College, Lahore.
3. MBBS, M.Phil (Microbiology), Assistant Professor Pathology, Central Park Medical College, Lahore.
4. MBBS, M.Phil (Hematology), Demonstrator Pathology, SIMS, Lahore.
5. MBBS, M.Phil (Microbiology), Assistant Professor Pathology, Central Park Medical College, Lahore.
6. MBBS, M.Phil (Hematology), Assistant Professor Pathology, University Medical and Dental College, Lahore.
7. MBBS, FCPS (Hematology), Professor Pathology, Central Park Medical College, Lahore.

Correspondence Address:
Dr. Namra Mahmood
Department of Pathology
Central Park Medical College, Lahore.
namramehmood2022@gmail.com

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thrombocytopenia were significantly more in patients with COVID-19 and also showed that total white blood count, lymphocyte count and neutrophil count were significantly different between patients and controls.[5] Pateints with COVID-19 showed neutrophilia, eosinophilia elevated D-dimers, ferritin, C-reactive protein and IL-6 as described by Bairwa et al.[6]

The purpose of the study was to know whether hematological and inflammatory parameters can be useful in assessing severity of disease and predict mortality in patients with COVID-19 so that patients at risk of severe infection can be identified and better management on priority can be given for improved outcome and reduction in mortality and morbidity.

MATERIAL & METHODS

It was a cross-sectional comparative retrospective study that was carried out at Central Park Teaching Hospital Lahore, COVID ward and ICU between 23rd April, 2021 to 23rd June, 2021. Study population was selected by convenient sampling and all patients admitted to the COVID ward and ICU during this time span of two months with positive COVID PCR were included in the study.

Patients less than 18 years of age, pregnant females and patients using medicines having anti-inflammatory potential were excluded from the study. Demographic and clinical data was obtained from patient's history record and laboratory parameters were obtained from hospital laboratory. Patients were grouped as having mild, moderate and severe disease.

Data was entered and analysed using SPSS 22. Mean and standard deviation was used for continuous variables and compared by using independent T test Chi square test was used for categorical variables. Statistical significance was taken as having p value of ≤ 0.05.

RESULTS

In this retrospective comparative study, 50 patients were included in which 29(58%) were males while 21(42%) were females with male to female ratio of 1.38:1. Though gender difference was not found to be statistically significant. The mean age of the patients was 65.2±08 years. The complete blood parameters-white blood count, absolute neutrophil count, lymphocyte count and neutrophil lymphocyte ratio were compared between groups and it was found that white blood count, absolute neutrophil count and neutrophil lymphocyte ratio were significantly different between different groups as shown in the Table-I.

Inflammatory markers like IL-6, ferritin, C-reative protein and d-dimers were also assessed in different severity groups and all were found to be significantly high in severe/critical group as shown in Table-II.

These parameters were also compared between those who survived and those who couldn't. It was found that in white blood cell parameters only total white blood count was significantly high in non-survivors with p-value of 0.003 and rest of the parameters were not significant between survivors and non-survivors. Inflammatory markers were compared between survivors and non-survivors and the results are shown in Table-III.

	Units	Mild Disease	Moderate Disease	Severe Disease	P-Value
WBC	$\times 10^3/\mu l$	21.76±8.07	19.42±7.84	21.76±9.07	0.002
Absolute neutrophil count	%	70.37±28.58	74.25±21.18	76.37±28.58	0.045
Lymphocyte count	%	22.50±28.41	20.06±20.84	28.41±28.41	0.8
Neutrophil lymphocyte ratio		10.38±11.05	11.20±8.20	13.80±10.56	0.000

Table-I. White blood cell parameters in different severity groups

	Reference Range	Total	Mild	Moderate	Severe	P-Value
		n=50	n=8	n=16	n=26	
CRP (mg/L)	≤5	50	8.45	10.86	14.12	0.001
IL-6 (pg/ml)	<7.00	50	65.11	168.75	311.24	0.006
Ferritin (μg/L)	30-400	50	1238.42	1660.37	2261.36	0.035
D-dimer (μg/L)	<250	50	664.51	1304.82	1671.86	0.002

Table-II. Inflammatory markers and different severity grops.

	Outcome	N	Mean	Std. Deviation	P-Value
CRP	Discharge	31	10.5395	7.54824	0.01
	Expire	19	12.2324	8.69476	
Serum Ferritin	Discharge	31	736.9205	490.42365	0.001
	Expire	19	3007.9231	1498.04966	
IL-6	Discharge	31	60.0672	50.44652	0.002
	Expire	19	329.1325	139.25384	
D-dimers	Discharge	31	908.4195	574.04592	0.013
	Expire	19	2177.7894	1993.40553	

Table-III. Comparison of inflammatory markers between survivors and non-survivors

DISCUSSION

In the present study, majority of the patients were males, though difference was not significant. Another study showed that in COVID patients, there is male predominance and they further added that this difference is not significant.[7] The other finding in our study was that patients of the severe disease group are of higher age group with respect to mild and moderate disease. The median age of the patients in severe group was 65.2 years. Similar findings were reported in the previous studies, as reported by Laninis and Pozdnyakova.[8,9]

In the present study, white blood count parameters were compared between groups. It was found that white blood count, absolute neutrophil count and neutrophil lymphocyte ratio were significantly different between groups and lymphocyte count was not found to be significantly different between different groups. Local and international studies have demonstrated similar findings. A local study conducted in Lahore by Taj et al. also showed the same findings.[1] Another study by Asghar et al also reported that total white blood count and neutrophil lymphocyte ratio were high in patients with critical disease.[10] It is said that neutrophil lymphocyte ratio alone has been observed to be able to predict the progression of the disease in patients with COVID-19 infection.[10,11]

In the present study, the relationship of disease severity and inflammatory markers were also studied. IL-6, C-reactive protein, D-dimers and ferritin were compared between groups that were mild, moderate and severe disease. It was found that these parameters were significantly high in patients with severe/critical COVID infection group. A study conducted by Bairwa et al. showed that C-reactive protein, procalcitonin and LDH was significantly high in patients who survived and those who could not survive.[6] Many studies have shown that high C-reactive protein, D-dimer, ferritin and procalcitonin were not only associated with raised mortality and morbidity but also with high rate of complications that may result into to death.[4,11,13]

Inflammatory parameters were compared between survivors and non-survivors and it was found that C-reactive protein, ferritin, IL-6 and D-dimers were significantly high among non-survivors. Similar observations were reported by Bairwa et al.[6] and Castro-Castro et al.[14] Similarly, white blood count was significantly high in patients who could not survice. A study conducted by Mattia et al showed that neutrophil lymphocyte ratio and white blood count were high in non-survivors.[15]

So it can be concluded from our study that simple inexpensive parameters like white blood count, neutrophil lymphocyte ratio and neutrophil count

can be used to evaluate the severity of disease and to predict those patients who are at increased risk of mortality. In the similar way, inflammatory markers like C-reactive protein, D-dimers, IL-6 and ferritin can be used to group the disease severity and also to monitor the disease. So these can be helpful in better management of the disease which will help to reduce the mortality and morbidity.

CONCLUSION

It is concluded that simple inexpensive parameters like white blood count, neutrophil lymphocyte ratio and neutrophil count can be used to evaluate the severity of disease and to predict who are at increased risk of mortality. In the similar way, inflammatory markers like C-reactive protein, D-dimers, IL-6 and ferritin can be used to group the disease severity and also to monitor the disease, progress.

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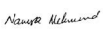
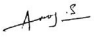
AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Namra Mahmood	Study design, data collection, writing the manuscript, formulation of tables statistical analysis reviewed and approved.	
2	Zahra Riaz	Study design, statistical analysis, result interpretation, manuscript writing and revising it critically for important intellectual content.	
3	Hira Tariq	Data collection, formulation of tables reviewed and approved the manuscript. Statistical analysis, interpretation of results, Reviewed and approvad.	
4	Fatima Altaf	Study design, data collection, writing the mansucript, formulation of tables reviewed and approved.	
5	Arooj Sattar	Study design, statsitical analysis, result interpretation, manuscript writing and revising it critically for important intellectual content.	
6	Sadia Ijaz	Study design, statistical analysis, result interpretation, manuscript writing and revising it critically for important intellectual content.	
7	Asma Saadia	Study design, statistical analysis, result interpretation, manuscript writing and revising it critically for important intellectual content.