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ORIGINAL ARTICLE

Role of Hematological Parameters in Predicting COVID-19 Disease Severity

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ABSTRACT

Background: Nowadays there is a global crises due to the emergence and spread of corona virus (CoV-19). This is a life threatening problem at present as it causes the severe acute respiratory syndrome corona virus (SARS-CoV).
Aim: To explore the value of changes in routine hematological parameters for prediction of COVID-19 disease severity among admitted patients**.**
Study design: Experimental study.
Methodology: Patients (n=222) having COVID-19 were enrolled. They were divided into two groups depending on the severity of disease. They were admitted into ITC and non-ITC. All patients underwent CBC and inflammatory markers. Various hematological markers were used as prognostic markers. Independent t-test and Chi square were applied and p value of <0.05 was taken significant.
Results: Mean age for ITC patients was 49.40±16.26 while the mean age for patients with mild disease was 40.88±15.48. NLR was significantly increased in ITC patients (p value<0.0001). Among biochemical parameters, serum ferritin, CRP and LDH were significantly increased in patients with severe disease (p value<0.001). D-Dimers were elevated in 68.75% patients of group-A and 17% patients in group-B with p-value<0.0001. **Conclusion:** We concluded that NLR and d-Dimers are the best hematology parameters in order to predict severity of disease.
Keywords: Covid-19, d-Dimers, NLR,NLM and Hematological Parameters.

INTRODUCTION

Nowadays there is a global crises due to the emergence and spread of corona virus (CoV-19). This is a life threatening problem at present as it causes the severe acute respiratory syndrome corona virus (SARS-CoV). This virus first appeared at China in 2019[1]. According to one estimate, almost 15000 deaths were reported globally. Similarly, situation in Pakistan is alarming as the confirmed COVID 19 cases in Pakistan has surpassed 154,760 deaths[2] and reported dearth were 136 in last 24 hrs.

The route of transmission of this virus is inhalational or contact with infected droplets. Its incubation period varies ranging from 2 to 14 day. It has variable clinical presentation that includes fever, cough, sore throat, breathlessness and fatigue.[3] Majority of the patients remain asymptomatic. Special care needs to be taken in the elderly patients with co-morbidities. They usually develop lung complications like pneumonia, ARDS, fibrosis and multi organ dysfunction[4].

Laboratory findings associated with it include low white cell counts with raised C-reactive protein (CRP), LDH and d-Dimers[5]. Advanced modalities like the computerized tomographic chest scan is of great help as it depicts chest abnormalities if present in asymptomatics or mild disease.

Its treatment is usually supportive as no proper treatment cure has yet been identified. There are preventive measures which we need to take and that include home isolation of suspected as well as mild cases and strict infection control measures to be followed at hospitals, markets and at places of social gatherings by using masks, proper hand washing, avoidance of hand shake and disinfectants[6,7].

Covid-19 infection results in prothrombotic endothelial injury which increases the risk of venous thromboembolism, pulmonary embolism, and acute myocardial infarction[8]. Pulmonary embolism and disseminated intravascular coagulation in COVID-19 patients are characterized by increased D-dimer levels and fibrin degradation products, which influence hemodynamic stability[9].

The complete blood count (CBC) is the initial investigation that is done when a patient presents to the hospital with any symptoms. Variety of hematological manifestations of SARS-CoV-2 range from cytopenias to coagulopathy. These findings help in disease prognostication in patients with COVID-19[10].

The objective of the study was to explore the value of changes in routine hematological parameters for prediction of COVID-19 disease severity among admitted patients**.**

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METHODOLOGY

An experimental study was conducted at department of Pathology, CMH, Multan, using purposive convenience sampling. Patients (n=222) having COVID-19 were enrolled. They were divided into two groups depending on the severity of disease. They were admitted into ITC and non-ITC. All patients underwent CBC and inflammatory markers. Various hematological markers were used as prognostic markers. Ethical approval was taken before research followed by written consent. SPSS software vision 23.0 was used for data statistics. Categorical variables were presented as frequency and percentages while quantitative data were represented as mean ± SD. Independent t-test and Chi square were applied and p value of <0.05 was taken significant.

RESULTS

A total of 222 patients COVID-positive patients were included in this study. Among them, 172(77%) were males and 50(23%) were females. Mean age for ITC patients was 49.40±16.26 while the mean age for patients with mild disease was 40.88±15.48 (p value=0.0046) as shown by table-1.

Table-1: Basic Characteristics among Participants

Gender	**Frequency**	**Percent**
Males	172	77%
Females	50	23%
Group-A (Admitted In ITC)		
Males	20	62.5%
Females	12	37.5%
Group-B (Not Admitted In ITC)		
Males	152	80%
Females	38	20%
Parameters	**Mean ± SD**	
Age (ITC patients)	49.40±16.26 years	
Age (Not ITC patients)	40.88±15.48 years	

The hematological parameters were compared between the two groups. The red blood cell count showed no difference (p

value=0.2). Hemoglobin, hematocrit, mean corpuscular volume and mean corpuscular hemoglobin was decreased in ITC patients (p value<0.05). ALC, AMC, LMR and platelet count were similar in both groups (p value>0.05). NLR was significantly increased in ITC patients (p value<0.0001) as shown by table-2.

Table-2: Comparison of Hematological Parameters between group A and B

Parameters	Disease severity	Mean ±SD	p-value
RBC(x10´12/L)	Group-A	4.57±0.74	0.2
	Group-B	4.74±0.70	
Hb (g/dl)	Group-A	12.17±1.91	0.0012*
	Group-B	13.36±1.90	
Hct (%)	Group-A	38.34±5.74	0.003*
	Group-B	41.58±5.64	
MCV (fL)	Group-A	83.28±4.74	0.0004*
	Group-B	87.57±6.39	
MCH (pg)	Group-A	26.65±2.13	0.0011*
	Group-B	28.31±2.69	
TLC(x10´9/L)	Group-A	10.79±5.84	0.03*
	Group-B	7.68±8.09	
ANC(x10´9/L)	Group-A	8.61±5.61	<0.0001*
	Group-B	4.81±2.92	
ALC(x10´9/L)	Group-A	1.58±0.89	0.944
	Group-B	1.57±0.73	
AMC(x10´9/L)	Group-A	0.27±0.17	0.7
	Group-B	0.28±0.13	
NLR	Group-A	9.29±12.46	<0.0001*
	Group-B	4.04±3.50	
LMR	Group-A	7.06±4.23	0.7
	Group-B	6.77±4.03	
Serum Ferritin(ng/ml)	Group-A	853.56±821.92	0.0008*
	Group-B	356.90±750.39	
CRP(mg/L)	Group-A	93.89±68.09	<0.0001*
	Group-B	30.48±47.35	
LDH (U/L)	Group-A	429.06±197.56	<0.0001*
	Group-B	281.74±101.47	

*Statistically significant

D-Dimers were elevated in 68.75% patients of group-A and 17% patients in group-B with p-value<0.0001 as summarized in table-3.

Table-3: Comparison of d-Dimer positivity in Both Groups

D-Dimers	Group-A	Group-B	p-value
Positive	22 (68.75%)	34(17.89%)	
Negative	10 (31.25%)	156(82.11%)	0.0001*

DISCUSSION

Severity of ongoing inflammatory response is linked with disease progression in covid-19 patients[8]. Various inflammatory biomarkers (CRP, serum ferritin and LDH) can be used to measure this inflammatory response[9]. Various studies showed that these inflammatory markers are raised extraordinarily among patients with severe covid-19 symptoms[10,11]. However few studies showed that there was no significant correlation of these biomarkers with Covid-19 disease and symptoms thus contradicted from results of present study[12,13].

In our study inflammatory markers (CRP, Ferritin, LDH) were raised in patients of both groups specially more raised among patients with severe disease admitted in ITC. However this difference was statistically significant. Many studies showed higher levels of CRP among their Covid-19 patients before treatment. However, their results showed reduction from 110.34 mg/L to 19.54 mg/L after steroid treatment[14,15].

In present study, hematological parameters among covid-19 patients with different severity were compared. Parameters (lymphocyte, NLR, monocyte, LMR, and neutrophil) were analyzed. In present study, higher levels of NLR and NLM were seen among patients admitted at ITC. Our results were similar to one study that showed an NLR value of 5.48 and LMR value of 2.85 admitted in an intensive care unit (ICU) as the potential markers for severity of disease. Similarly, the higher level of NLR during hospitalization in severe patients in this study also suggested an association of NLR with disease severity and clinical course[16].

In present study, d-Dimers were elevated in 68.75% patients of group-A and 17% patients in group-B. Literature review revealed that raised d-Dimer levels occur in severe COVID-19 patients admitted at ITC[7,8]. Similarly, d-Dimer levels above 1000 µg/L indicate poor prognosis even at an early stage[9,16]. Thus this can help clinician to have idea about prognosis of disease.

CONCLUSION

We concluded that combined NLR and d-Dimers are the best hematology parameters in order to predict severity of disease. Thus these parameters can be used as prognostic indicators inorder to prevent and control the epidemic of this disease.

Limitations: Financial resources with lack of genetic workup and unequal grouping contributed to generalize the results.

Authors' Contribution: SBZ&JZC: Conceptualized the study and formulated the initial draft, **HI&HZ:** Contributed to the analysis of data and proofread the draft, **ZER& STM:** Collected data.

Conflict of Interest: None to declare

Financial Disclosure: None

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