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IMPACT OF COVID-19 ON HEMATOLOGICAL PARAMETERS-A SINGLE CENTRE STUDY, INDIA.

Pathology

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ABSTRACT

Aims and Objectives: To analyze various hematological parameters in Covid-19 infected patients.

Patients/Materials and Methods: This is a retrospective, single centre cross sectional study conducted in a tertiary care hospital, located in a tri-state region. Data was collected from patients admitted in Covid-19 ward and ICU between 28 July to 7 September 2020, confirmed positive for Covid-19 infection. Basic demographic data was collected from Laboratory Information System(LIS) of our hospital . Whole blood EDTA sample sent from Covid-19 ward and ICU were processed in LH780/DXH 500(Beckman coulter) for complete blood counts. Further patients laboratory features were analyzed .

Results: Findings of 338 patients, both from ward and ICU, showed varied hematological parameters. Demographic data revealed age range from 1day to 86 years. Males constituted 205(60.65%) and females 133(39.34%). Complete Blood Count(CBC) showed Hemoglobin(Hb) concentration ranged from 5.8 -18.5gm/dL and median value 13.6gm/dL. Red cell distribution width(RDW) ranged from 11.4-39.9% with median value of 13.6%. Leucocytosis was observed in 13.9% of patients, high absolute neutrophil count in 15.6% ,high Neutrophil Lymphocyte Ratio(NLR) in 10.05% patients and eosinophil count ranged from 0-15.3%.

Conclusion: Baseline alterations in CBC parameters of 10-15% of patients in the present study along with articles reviewed from various countries indicate Covid -19 infection causes systemic infection involving multiple organs and systems

KEYWORDS

Covid-19, Leucocytosis, Absolute neutrophil count, Neutrophil Lymphocyte ratio

INTRODUCTION:

Coronaviruses (CoVs) are a large virus group belonging to the Coronaviridae family , with a single-stranded RNA genome. The genome is surrounded by a helical capsid and a lipoprotein envelope containing several spicules of glycoprotein that together give the virus a crown appearance, hence the name "corona" which in Latin, means crown.[1]

In December 2019, Covid-19 outbreak occurred in Wuhan, China, and has rapidly infected people all over the world presenting with clinical features of flu like symptoms to multi organ failure and death.[2] Respiratory droplets and contact transmission are the main routes of spread of Covid-19 virus.[3] On 11th, March 2020 ,WHO declared Covid-19 as pandemic. India confirmed its first positive case on 30th January 2020 in Kerala.[4]

Currently, novel corona virus has affected 39 million people all over world and 11 lakh deaths have been reported in the mid October 2020 as revealed by WHO's online dashboard.[5]

As complete blood count is the most common laboratory test performed and many of the hematological indices are varied in Covid-19 infected patients as revealed by the articles published by various countries .Lymphocyte count as observed in severe/critically ill patients were reduced and different degrees of erythrocyte and hemoglobin decrease was also observed.[3] Neutrophil Lymphocyte ratio(NLR) has been suggested as a marker of systemic inflammatory response in critically ill patients.[6]

In the present study we planned to analyze routine hematological parameters in Covid-19 hospital admitted patients so that patients can be treated early with a limited resources available in an ongoing pandemic.

AIMS AND OBJECTIVES:

To analyze various hematological parameters in Covid-19 infected patients.

MATERIAL AND METHODS:

The present study is a retrospective, single centre cross sectional study conducted in a tertiary care hospital, located in a tri-state region.

Data was collected from patients admitted in Covid-19 ward and ICU between 28 July to 7 September 2020, confirmed positive for Covid-19 infection. Basic demographic data was collected from Laboratory Information System(LIS) of our hospital .Whole blood EDTA sample sent from Covid-19 ward and ICU were processed in LH780/DXH 500(Beckman coulter) for complete blood counts. Further patients laboratory features were analyzed .

STATISTICAL ANALYSIS:

The data were entered into MS Excel 2007 version and further analyzed using SPSS 20. For descriptive analysis, the categorical variables were analyzed by using percentage and continuous variables analyzed by calculating mean+/- Standard deviation.

RESULTS:

Out of 338 patients in the present study, age of the patients ranged from 01 day to 86 years .Male patients constituted 205(60.65%) and females 133(39.34%).Male to female ratio was 1.5:1.Peak number 76(22.4%) of patients were in the age group of 51-60 yrs. Table:1 reveals age and gender wise distribution of Covid-19 patients.

Table1:Age and gender wise distribution of Covid-19 patients

Age range	Male	Female	Total
1 day	1	0	1
01-10years	5	3	8
11-20years	8	12	20
21-30years	27	24	51
31-40years	47	24	71
41-50years	34	21	55
51-60years	49	27	76
61-70years	22	17	39
71-80years	9	5	14
81-90years	3	0	3
Total	205	133	338

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Table:2 Hematological parameters in Covid-19 patients.

Parameters	Mean	Median	Range
HB	13.44gm/dL	13.6gm/dL	5.8-18.5 gm/dL
RBC	4.76million/cmm	4.79/cmm	1.79 – 6.91/cmm
RDW	14.46%	13.6%	11.4-39.9%
WBC	7,770/cmm	6,900/cmm	2,600-33,600/cmm
Neutrophil	57.75%	55.65%	27.6 - 96.1%
ANC	4,650/cmm	3,900/cmm	1,300-31,000/cmm
Lymphocyte	31.55%	33%	2-62%
ALC	2,320/cmm	2,100/cmm	0.2 -15.2
Eosinophil	2.01%	1.5%	0 -15.3%
Platelets	271.17lakh/cmm	260.5lakh/cmm	45-5825lakh/cmm
PLR	91.98	78.38	11.16-344
NLR	2.89	1.68	0.44-56.5

Hemoglobin concentration, RBC and RDW :

Hemoglobin concentration ranged from 5.8 -18.5gm/dL and median value was 13.6gm/dL. Hemoglobin <11gm/dL were 58(17.1%) patients among them 35 were females and 23 were males.

RBC ranged from 1.79 - 6.91million/cmm and median value was 4.79 million/cmm.

RDW ranged from 11.4-39.9% with median value of 13.6%.Higher RDW(>14%) was found in 117(34.6%) patients. Males were 56 and females constituted 61.

Total White blood cell(WBC) count, Absolute neutrophil count(ANC),Absolute lymphocyte count(ALC) and Neutrophil Lymphocyte ratio (NLR) :

Total WBC count of the patients ranged from 2,600-33,600/cmm. Out of 338 patients,47 (13.9%)patients showed leucocytosis (>11,000/cmm).Males constituted 25 cases and females 22. Leucopenia (<4,000/cmm) was observed in 9 patients.

High ANC(>7,000/cmm) was observed in 53(15.6%) patients. Among 53 patients ,42 showed leucocytosis and 11 patients showed normal WBC count. Males constituted 27 and females 26 cases.

Low ALC(<1,000/cmm) was observed in 19(5.62%) patients. Males were 17 and 2 female patients.

Out of 338 patients, NLR ranged from 0.44-56.5. High NLR (>4.5) was observed in 34(10.05%) patients and 25 patients were male and 9 were female.

Eosinophil count:

Eosinophil count ranged from 0-15.3% with a median of 1.5%. Eosinopenia was observed in 129(38.1%) patients.

Platelet count and PLR:

Platelet count ranged from 45,000-5,82,00/cmm. Thrombocytopenia (<1lakh/cmm) was observed in 6(1.77%) patients. Males were 5 and 1 female patient. Thrombocytosis (>4.5lakh/cmm) was observed in 17(5.02%) patients. Males were 7 and 10 were female patients. PLR ranged from 11.16-344 with median value of 78.38.

DISCUSSION:

The study reviewed 338 Covid-19 positive patients which included 330 adults and 9 children(<10 years).The hematological parameters observed in children were within normal physiological limits.

Demographic characteristics of our study showed age of patients ranged between 1day -86 years with median of 45 years. A study done by Zhu W *et al*[7]. also showed a median age of 46 years. Male to female ratio observed in the study was 1.5:1.This was similar to a study done by Chen N *et al*[8] .the disease incidence was more in males compared to females. The reduced susceptibility in females was attributed due to X chromosome and sex chromosomes, which play an important role in innate and adaptive immunity.[8]

Hemoglobin concentration, RBC,RDW:

In the present study, low hemoglobin was observed in 58(17.1%) patients. These results are consistent with the findings of Sun S *et al*[9]. and Wang C *et al*[10].

Anisocytosis of circulating erythrocytes is considered as red blood cell distribution width.[11] High RDW was observed in 34.6% of patients . High RDW and higher values of NLR was observed in 19 patients in present study. In a pooled analysis done by Lippi G *et al*[12] RDW was higher in Covid-19 patients with severe illness compared to mild disease. Wang C *et al*[10]. also observed similar findings in his study and concluded combined parameters of NLR and RDW can be used as important indicator to distinguish between severe and moderate patients of Covid-19.

Several pathogenesis has been put forth for causes of anemia. Covid-19 cause damage to renal tissue, rich in ACE-2 receptors ,thereby reduces erythrogenesis and further leading to anemia.[9] In a study done by Cavezzi, A *et al*[13].virus inhibits heme metabolism and leads to hemoglobin dysfunction. However, in our study pre-existing anemia could not be ruled out .Low hemoglobin concentration and high RDW may be due to suppression of bone marrow, compensatory hyperplasia of red blood cells, activation of red blood cell apoptosis and increased phagocytosis.[10]

Total White blood cell(WBC) count, Absolute neutrophil count(ANC),Absolute lymphocyte count(ALC) and Neutrophil Lymphocyte ratio (NLR) :

Although 13.9% of patient showed leucocytosis and high ANC in 15.6% ,this was similar to a study done by Blomme S *et al*[14]. ,leucocytosis and high neutrophil count was observed due to superimposed bacterial infection that plays an important role in Covid-19 patients outcome.

Low ALC was observed only in 19 patients in the present study. However, in a study done by Zhu W *et al* [7]. and Jyoti C *et al* [15]. leucopenia was observed in 59% and 100% of patients.

High Neutrophil Lymphocyte ratio(NLR) was observed in 34(10.05%) patients. In a study done by Yan X *et al*[6].high NLR was observed in non survivors compared to survivor group. Neutrophils are hyperactivated in sepsis and delayed apoptosis being the common events in Covid-19.[2] NLR is a biomarker of disease severity such as sepsis and bacteremia. NLR appears to be an efficient indicator of mortality in Covid-19 patients.[2,6,18]

Eosinophil count:

Eosinopenia was observed in 38.1% of patients . In a study done by Xie G *et al*[17]. and Du Y *et al*[18] eosinopenia was observed in 71.7% and 81.2% respectively. In Covid-19 , eosinopenia may be due to decrease in bone marrow release of eosinophils,[17,19] blockade of eosinophilopoiesis or eosinophil apoptosis induced by type 1 IFN released during acute infection.[19] To conclude, eosinophil count can be used as efficient and prognostic indicator in association with other laboratory tests in Covid-19 patients.

Platelet count and PLR:

In a study by Qu R *et al* [20]. ,peak platelet count and high PLR had a longer hospitalization days in Covid-19 patients. Present study revealed thrombocytopenia(<1lakh/cm) in 6(1.77%) patients and thrombocytosis (>4.5lakh/cmm) in 17(5.02%) patients. Importance of platelet count and PLR can only be interpreted if follow up samples at different time points were available.

Limitations of the study:

The study had some limitations. First, it was a retrospective study and a single run of complete blood count were included and follow up was not possible. Second, severity of the patients were not categorized and compared .Thirdly, prognosis of the patients could not be analyzed based on hematological parameters.

CONCLUSION:

The present study of 338 Covid-19 patients showed higher incidence in males. Baseline complete blood counts revealed low hemoglobin, high RDW, leucocytosis, high ANC, high NLR , and eosinopenia .Covid-19 infection causes systemic infection involving multiple organs and systems.

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