

Evaluation of role of hematological parameters in patients with Covid-19 infection : A study at private pathology laboratory

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Abstract

Background: SARS COV2 is the third known corona virus responsible for fatal respiratory illness in humans. Abnormalities in the routine laboratory tests particularly hematological tests have the potential to indicate in a quick, practical and economical way, the need for a specific laboratory test for the diagnosis for SARS COV2. Patients of covid-19 pneumonia present with a wide range of hemostatic abnormalities. These hemostatic abnormalities in COVID-19 are related with disease progression, severity and mortality. Besides these tests help in assisting the prognosis of the disease and clinical monitoring. **Aims:** to evaluate the role of hematological parameters in determination of COVID-19 disease severity. **Settings and Design:** The present study was prospective and observational study by observing the haematological parameters of 200 COVID19 positive patients. **Materials and Methods:** 200 Patients' blood samples were tested for CBC (Complete Blood Count)(by 3part Mindray analyzer), coagulation profile, ESR (Erythrocyte sedimentation Rate), CRP (C Reactive Protein), Ferritin, peripheral smear examination as well as RTPCR (Reverse transcription polymerase chain reaction). **Statistical analysis used:** Categorical variables were expressed as frequencies and percentages. **Results:** 200 samples were tested for Complete blood count and significantly higher values were found in TLC, Neutrophil count as well as N:L ratio (Neutrophil:Lymphocyte Ratio), while lymphocyte values were significantly decreased. Thrombocytopenia and high ESR values were present in a significant number of patients. Coagulation profile, CRP, Ferritin values and peripheral smear findings were significantly deranged. **Conclusion:** Hematological and Biochemistry abnormalities in COVID 19 are significantly related with disease progression, severity and mortality.

Key words: COVID 19 disease, Haematological parameters, coagulation profile, N: L ratio. (Neutrophil :Lymphocyte Ratio), CRP(C Reactive Protein), Ferritin

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Introduction

Coronavirus disease causing severe acute respiratory syndrome has rapidly evolved into a global pandemic effecting more than 100 million individuals worldwide[1].

SARS COV2 is the third known corona virus responsible for fatal respiratory illness in humans. The initial clinical features of the disease are quite often non-specific and not all suspected patients can be tested to exclude or confirm the disease. Abnormalities in the routine laboratory tests particularly hematological tests have the potential to indicate in a quick, practical and economical way, the need for a specific laboratory test for the diagnosis for SARS COV2. Besides these tests help in assisting the prognosis of the disease and in the optimization of its clinical monitoring[1].

Patient suffering from COVID-19 shows alterations of many hematological parameters like Total WBC count, Hemoglobin, Neutrophil count, Lymphocyte count, NLR (neutrophil lymphocyte ratio), Platelet count and ESRESR (Erythrocyte sedimentation Rate). Platelet count is a simple and effortlessly available hematological parameter, which is independently associated with disease severity and risk of mortality in the intensive care unit (ICU). Coagulopathies like disseminated intravascular coagulation, sepsis-induced coagulopathy (SIC), local microthrombi, venous thromboembolism (VTE), arterial thrombotic complications, and thrombo-inflammation have been associated with COVID-19[2].

This study was carried out to observe the changes of various

hematological and biochemistry parameters in patients with SARS COV2 infection and to determine the prognostic predictor role of these parameters.

Aims and objectives

1. To evaluate the role of hematological parameters in SARS COV2 positive patients.
2. To evaluate role D-DIMER in SARS COV2 positive patients.
3. To evaluate role of CRP(C Reactive Protein) and Ferritin in SARS COV2 positive patients.

Material & methods

This study was conducted in a Private Pathology Laboratory; by evaluating the haematological parameters of 200 COVID19 positive patients admitted in the COVID private hospital as well as Outdoor Patients. 200 Patients' blood samples were tested for CBC(Complete Blood Count), coagulation profile, ESR, CRP(C Reactive Protein), Ferritin, peripheral smear examination as well as RTPCR(Reverse transcription polymerase chain reaction). All laboratory confirmed covid positive cases (by RT-PCR) were included. Suspected cases with symptoms of URTI(Upper respiratory tract infection) but negative for RT-PCR test result OR test not done were excluded.

Complete Blood Count was performed on 3 part Mindray analyzer, For D dimer & Ferritin - MINIVIDAS -BIOMR RIEUX Machine and For CRP - Cobas (C-111) from ROSCH was used.

For peripheral smear examination routine smear preparation followed by staining by Leishman stain and examination under oil immersion microscope was done.

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Results

Total of 200 patients were studied who had tested positive for SARS COV2 by RT-PCR test. Various hematological parameters were evaluated after doing a CBC examination. D-Dimer levels were also measured. ESR as well as peripheral smears and Ferritin, CRP of the patients were also tested and following results were obtained.

It was observed that majority of the patients (24.5%) who required hospitalization were between the age of 51 to 60 years followed by group of 41 to 50 years (22.5%). All other age group persons were affected less commonly.

Male preponderance (75.5%) was observed over females (24.5%).

Many patients had more than one complains. Most common complaints being weakness and fever followed by cough, breathlessness, and loss of taste/smell.

It was observed that majority of patients (84%) had CT value between 20-30, 16 % had <20 CT value and 16 % had CT value more than 30. Most common affected age group was between 50-60yrs with CT value between 20-30 (20.5%).

It was observed that majority of patients (48%) had hemoglobin in the normal range (>12gm/dl) while 21% patients had decreased haemoglobin of <10 gm/dl the others (41.5%) had haemoglobin values in between the 10-12gm/dl.

Table I: Total WBC Count in COVID 19 positive patients (n=200)

Age Group	<4000	4000-11,000	>11,000
0-10	00(0%)	00(0%)	01(0.5%)
11-20	00(0%)	01(0.5%)	03(1.5%)
21-30	03(1.5%)	14(7.0%)	07(3.5%)
31-40	02(1.0%)	22(11.0%)	20(10%)
41-50	03(1.5%)	25(12.5%)	05(2.5%)
51-60	04(2.0%)	10(5.0%)	35(17.5%)
>60	03 (1.5%)	12(6.0%)	30 (15.0%)
TOTAL	15(7.5%)	84(42%)	101(50.5%)

From above table it was observed that majority of the patients (50.5%) had leucocytosis in the range of >11,000 cells/cumm while 42.0% had normal leucocyte count in the range of 4000-11,000 cells/cumm and 7.5% had leucopenia total count being <4000 cells/cumm.

Table II: N:L ratio (Neutrophil: Lymphocyte ratio) in covid 19 positive patients (n=200)

Age Group	<3	>3	Total
0-10	0(0%)	1(0.5%)	01
10-20	1(0.5%)	3(1.5%)	04
20-30	10(5.0%)	16(8.0%)	26
30-40	23(11.5%)	20(10.0%)	43
40-50	18(9.0%)	20(10.0%)	38
50 -60	20(10.0%)	31(15.5%)	51
>60	17(8.5%)	20(10.0%)	37
TOTAL	89(44.5%)	111(55.5%)	200

Out of total 200 patients 55.5% (111 patients) had NLR of >3 while remaining 44.5% (89 patients) had NLR of <3. Patients having higher NLR had poor general outcome and required either ventilator support or died due to the disease. (Note: patients showing ~90% neutrophilia or ~3-4 % lymphopenia showed poor prognosis)

Table III: Platelet count in COVID 19 positive patients

Type	Range of platelet count/ml	No of patients	Percentage(%)
Normal	150000 to 450000	70	35%
Mild thrombocytopenia	100000 to 150000	66	33%
Moderate thrombocytopenia	50000 to 99000	40	20%
Severe thrombocytopenia	<50000	24	12%
Total		200	100%

Above table shows that 33% patients had mild thrombocytopenia, 20 % had moderate While only 12% had severe thrombocytopenia necessitating vigorous treatment. Overall, 65 % patients showed thrombocytopenia while 35 % had normal platelet count.

It was observed that majority of patients (53%) had ESR between 50-100 mm/hour, while 34% of patients had ESR in range of 20-50 mm/hour and 12% had ESR <20 mm/hour Majority of patients had neutrophilia (64%) with lymphopenia.

Table IV: D-Dimer in COVID 19 positive patients (n=200)

D- Dimer test result	No. of patients
>500 ng/ml	76(38%)
< 500 ng/ml	124(62%)
TOTAL	200

From the above table it was observed that 62% patients had Normal D-DIMER values, while 38% patients had high D-DIMER values

Table V: LDH in COVID 19 positive patients (n=200)

LDH test result	No. of patients
>450 U/L	50(25%)
< 450 U/L	150(75%)
TOTAL	200

From the above table it was observed that 75% patient had Normal LDH values; while 25% patients had high LDH values.

Table VI: Ferritin in COVID 19 positive patients (n=200)

Ferritin test result	No. of patients
>200 ng/ml	55(27.5%)
< 200 ng/ml	145(72.5%)
TOTAL	200

From the above table it was observed that 72.5% patients had Normal Ferritin levels; while 27.5% patients had high Ferritin levels.

Discussion

SARS COV2 shows more positivity in the middle and older age groups as compared to younger population. Most common presenting complaint was fever and weakness followed by breathlessness especially in patients having co-morbidities or those who ignored their symptoms initially thinking it to be simple common cold. Similar symptoms were observed by Huang et al in his study[3].

Older patients with various co-morbidities almost always required hospitalization with oxygen support. Similar findings were observed in a study of Terpos E et al., and Sadia et al who described older age and male gender as risks factors for severe disease and death in patients with COVID-19 [1,4].

Our study reported that males were more affected than females.(75.5:24.5) Sadia et al and Jin JM et al., also reported that according to the clinical classification of severity, men had more severe disease than the women[4,5].

As for hematological parameters, hemoglobin (Hb) was in near normal range in most of the patients, while total leucocyte count (TLC) was high in initial phase followed by a dip in subsequent workup suggesting improvement. In patients with normal range or low TLC home quarantine with adequate fluid and vitamin support was the adequate treatment in most of the cases thus reducing the load on health care system and resources. In patients with persistently high total leucocyte count, severe disease was suggested requiring vigorous treatment and thereby hospitalization. In differential leucocyte count (DLC) most common spectrum was severe neutrophilia with lymphopenia. About 55.5 % patients had N: L ratio of > 3 on admission suggesting a grave prognosis. Erythrocyte sedimentation rate (ESR) was high in > 53% patients in the range of 50-100 mm/hr. suggesting the inflammatory nature of the disease. Thrombocytopenia was present in about 65 % of patients varying from mild, moderate to severe levels. Severe thrombocytopenia was associated with grave prognosis

Leukocytosis, neutrophilia and increased neutrophil to lymphocyte ratio, which might be due to inflammatory response, have a significant association with the disease severity. Neutrophil to lymphocyte ratio was highest in patients with critical disease. Sadia et al and Liao D et al. and yang AP et al also found elevated neutrophil to lymphocyte ratio as a useful predictor for severity and mortality of SARS-CoV-2 infection[4,6,7].

CT value in RTPCR report was between 20-30 in majority of the patients. CT value less than 20 showed severe disease(16%).

Qualitative D Dimer positivity was seen in around 38% suggesting that significant amount of fibrin degradation products and D.I.C was present thus requiring appropriate thrombolytic therapy. In a meta-analysis done in June 2020, Bansal A et al., showed significant association of D-Dimers with the severity of the COVID -19 disease. Patients with increased D-Dimer levels had worst clinical outcome[8].

LDH value were significantly high in 25 % of patient signifying effect of SARS COV 2 on Liver. Similar findings were observed by Wu C et al[9].

Ferritin value increased in 27.5 % of patients amongst the patient who admitted in hospital, specially patient who are having comorbidity i.e. diabetes. Chen et al. analyzed the clinical characteristics of 99 patients, in which 63 of them had serum ferritin way above of the normal range[10]. Elevated ferritin levels were found also in

autopsies of 12 patients whose cause of death was SARS-CoV-2 infection BY Fox SE et al[11].

Poor prognostic parameters such as N:L ratio of > 3, increased ESR, decreased platelets increased Ferritin, High LDH, CT value less than 20 as well as persistently high D Dimer levels were seen in patients with severe disease requiring hospitalization with intensive therapy, oxygen therapy with Bipap and/or ventilator support.

Conclusion

The study concluded that Leukocytosis, neutrophilia, elevated Neutrophil to lymphocyte ratio, APTT, D-dimer, LDH and serum ferritin and CRP are significantly increased in patients with severe and critical disease. Hematological and coagulation manifestations are directly related to covid-19 disease and these markers may be utilized as useful prognosticator for early prediction of disease severity. Thus, appropriate management can be planned for such patients before the patient develops organ failure or shock.

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