



ORIGINAL RESEARCH PAPER

Pathology

EVALUATION OF HAEMATOLOGICAL PARAMETERS IN PATIENTS WITH COVID-19 INFECTION – A TEACHING HOSPITAL EXPERIENCE

KEY WORDS: COVID-19, SARS-CoV-2, TLC, ANC, ALC, AMC.

Dr. Amit Kumar Bhardwaj	Assistant Professor, Department of Pathology, Pt JNM Medical College, Raipur (C.G.).
Dr. Bimla Banjare*	Associate Professor, Department of Pathology, Pt JNM Medical College, Raipur (C.G.). *Corresponding Author
Prof. Arvind Neralwar	Professor, Department of Pathology, Pt JNM Medical College, Raipur (C.G.).
Dr. Deepak Gupta	Resident, Department of Pathology, Pt JNM Medical College, Raipur (C.G.).
Dr. Rabia Parvin Siddiqui	Associate Professor, Department of Pathology, Pt JNM Medical College, Raipur (C.G.).

ABSTRACT

Introduction - The mankind is facing a major pandemic seen in decades known as COVID-19 disease whose etiological agent is Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2).[1] Haematological Parameters play a very important role in the management of the disease.[4] The present study was designed to evaluate the Haematological Parameters and assess any significant findings associated with the severity of COVID-19 disease.

Methods - The COVID-19 RT-PCR confirmed cases were admitted in Dr. Bhim Rao Ambedkar Memorial Hospital, Raipur, Chhattisgarh, India. Two groups were formed and admitted according to the severity of the disease and ICMR Guidelines. Asymptomatic and Mildly Symptomatic cases (ILI cases) were admitted in COVID ward while Severe cases presenting with SARI were admitted in ICU Ward. Haematological Parameters of both the groups from 1st June 2020 to 31st July 2020 were assessed and Biostatistical Analysis was done.

Results - Total 87 RT-PCR COVID-19 confirmed cases were admitted with 67 admitted in COVID Isolation ward (Non-ICU) & 20 in ICU ward respectively. No gender differentiation was observed regarding COVID19 infection. Median age of admission is 41.2 years (± 15.5 years, n=87) with ICU admission at 52 years (± 13.9 years, n=20) and Non-ICU admission at 38 years (± 14.4 years, n=67).

Conclusion - Mean age of Hospitalization in COVID19 disease is 41.2 years ((±15.5, n=87) with ICU admission at 52 years (± 13.9, n=20) and Non-ICU admission at 38 years (± 14.4, n=67). Severity of COVID19 disease increases with senility and co-morbidities while high and/or increasing Total Leucocyte Count (TLC), Absolute Neutrophil Count (ANC), Absolute Monocyte Count (AMC) & low and/or decreasing Absolute Lymphocyte Count (ALC) are the most important Haematological Parameters for COVID-19 diagnosis, severity assessment, prognosis and management.

INTRODUCTION

The mankind is facing a major pandemic seen in decades known as COVID-19 disease whose etiological agent is Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2).[1] The present pandemic has involved more than 150 countries of the World and has caused approximately 2 crore 35 lacs confirmed cases with mortality of approximately 8 lacs 10 thousand.[2] The SARS-CoV-2 virus belongs to the family Coronoviridae, has a positive strand RNA genome and a viral envelope. The Corona Virus group has been previously associated with outbreaks of Severe Acute Respiratory Syndrome (SARS 2002) and Middle East Respiratory Syndrome (MERS 2012).[3,5,6] Haematological Parameters play a very important role in the management of the disease.[4] The present study was designed to evaluate the Haematological Parameters and assess any significant findings associated with the severity of COVID-19 disease. India confirmed its first COVID-19 case on 30 January 2020.

Infection by SARS-CoV-2 is confirmed by Real Time Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR), which is done on Nasopharyngeal and Oropharyngeal Swab Specimens. The first case of Covid-19 case in Chhattisgarh was reported on 19th March 2020 and then the cases have increased tremendously in the State. The Covid-19 patients tested positive with RT-PCR were admitted in Dr. Bhim Rao Ambedkar Memorial Hospital, Raipur, Chhattisgarh, India on two groups according to the severity of the signs & symptoms of the disease. First group were Asymptomatic and Mildly Symptomatic cases (Influenza like Illness - ILI) cases &

admitted in specifically formed COVID Isolation Ward while second group consisted of Severe cases (Severe Acute Respiratory Infection - SARI) & admitted in ICU Ward.

AIMS & OBJECTIVE:

1. To evaluate the Haematological Parameters of COVID-19 disease.
2. To assess Haematological Parameters associated with the severity of COVID-19 disease.

MATERIALS & METHOD:

Study Design: Observational Cross-Sectional Study.

Place Of Research: Dr. Bhim Rao Ambedkar Memorial Hospital associated with Pandit Jawaharlal Nehru Memorial Medical College, Raipur (Chhattisgarh) – largest Teaching Hospital of Chhattisgarh State of Central India.

Study Period: 1st June 2020 to 31st July 2020 – 2 months.

Study Subjects: All COVID-19 RT-PCR confirmed cases were divided into 2 groups according to severity of the Disease.

- Non-ICU Group – Asymptomatic and Mildly Symptomatic Cases (Influenza like Illness - ILI).
- ICU Group - Severe cases (Severe Acute Respiratory Infection - SARI)

Inclusion Criteria: Admitted COVID 19 Patients.

Exclusion Criteria: All Non-COVID 19 patients.

METHODOLOGY:

Retrospective Data collected of all COVID-19 patients which were tested for Haematological Parameters in Clinical Pathology Section, Department of Pathology, Dr Bhim Rao Ambedkar Memorial Hospital associated to Pandit Jawaharlal Nehru Memorial Medical College, Raipur, Chhattisgarh from 1st June 2020 to 31st July 2020.

The data was collected and compiled and presented in form of Tables, Percentages, Charts, Graphs and Histograms. The Mann-Whitney U Test for Non-Parametric data were analyzed by www.socscistatistics.com online calculator. P- value < 0.05 was taken for significance.

RESULTS:

A total number of 87 patients, confirmed for SARS-CoV-2 virus by RT-PCR were admitted in Dr. BRAM Hospital, Raipur, Chhattisgarh during the Study period. We divided the patients into two groups – i) non-ICU and ii) ICU patients. Out of 87 patients, 67 (77%) patients presented with no symptoms or mild symptoms like mild fever, light headedness, lethargy etc. and hence placed in first group while other 20 (23%) presented with more severe signs & symptoms like high grade fever, perspiration, malaise, headache, bodyache, palpitations, difficulty in breathing, low spO2, etc. and placed in second group.

Table 1:

	No. of Cases	Percentage
Asymptomatic/ Mild Symptoms	67	77%
Severe Symptoms	20	23%
Total	87	100%

Among Non-ICU group Sex distribution was insignificant (M-34, F-33) but surprisingly significant in ICU Group where Females (12) were more in numbers than Males (8). It implies that both sexes are equally predisposed to COVID 19 infection and elderly Females have more chances of landing in ICU than Males. It can be due to late testing and intervention, unscreened co-morbidities, post-menopausal hormonal effects and negligence towards Women health, widely prevalent in India which all causes increased Viral Load and severe presentation.

Table 2: Sex Distribution

	Male			Female			Total
	No. of patients	Mean Age (yrs)	SD	No. of patients	Mean Age (yrs)	SD	
ICU	8	51	12.2	12	53	14.9	20
Non-ICU	34	40	15.3	33	36	13.2	67
Total	42	41.9	15.4	45	40.4	15.5	87

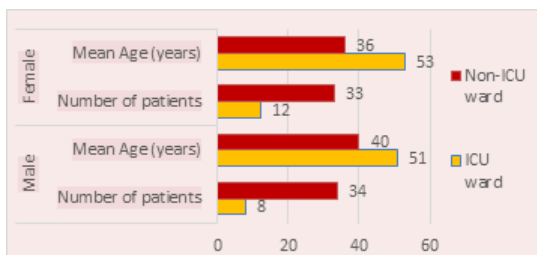


Chart 2: Sex Distribution

There is a significant 14 years difference in Mean Age between both the groups (ICU - 52 ± 13.9 years, n=20 with Non-ICU - 38 ± 14.4 years, n=67). It shows that peoples >40 years of age are more predisposed than young adults (<40 years) for COVID19 infection and present with more severe sign and symptoms requiring ICU admission. This finding is similar to study by Velavan TP et al [14] which showed that old age and co-morbidities are major factors for ICU admittance.

Table 3a: Mean Age Of Presentation

	ICU	Non -ICU	Total
Mean Age (in years)	52	38	41

Table 3b: Agewise Sex Distribution

Age Distribution	ICU group			Non - ICU group		
	Male	Female	Total	Male	Female	Total
< 20 years	0	0	0	4	0	4
21 – 30 years	1	1	2	6	17	23
31 – 40 years	0	2	2	11	4	15
41 – 50 years	3	2	5	3	7	10
51 – 60 years	2	3	5	6	2	8
61 – 70 years	2	2	4	3	3	6
> 70 years	0	2	2	1	0	1
TOTAL	8	12	20	34	33	67

On observing the Agewise distribution pattern, among ICU group, maximum number of patients were seen equally in 41-50 years & 51-60 years agegroup (n=5 each) followed by 61-70 years agegroup. Instead in, Non-ICU group maximum cases were seen in 21-30 years (n=23) followed by 31-40 years (n=15) & 41-50 years (n=10) agegroups. It asserts again that younger peoples present more with No symptoms or Mild symptoms whereas elderlies, especially 41-60 years present with more Severe symptoms and require special ICU care.

Table 4: Median Values & IQR

Parameters	ICU		NICU		Mann-Whitney U Test	
	Median	IQR	Median	IQR	p-value	Significance
TLC (n/µl)	13755	7620	9930	8980	> 0.05	Insignificant
ANC (n/µl)	11547.33	6670.193	7410.399	8224.902	< 0.05	Significant
ALC (n/µl)	1055.394	1379.824	1379.735	993.031	> 0.05	Insignificant
AMC (n/µl)	798.374	665.6647	547.539	406.164	< 0.05	Significant
AEC (n/µl)	79.7585	58.4217	63.848	94.115	> 0.05	Insignificant
ABC (n/µl)	57.7555	57.5983	48.64	64.912	> 0.05	Insignificant
Hb% (g/dl)	13.12	4.055	11.8	3	> 0.05	Insignificant
PCV	39.15	13.35	34.9	8.5	> 0.05	Insignificant
MCV (fl)	86.5	6.05	83.9	9.8	> 0.05	Insignificant
MCH (pg)	29.2	1.8975	29.4	3.65	> 0.05	Insignificant
MCHC (g/dl)	33.55	1.325	35.1	2.2	< 0.05	Significant
RDW (%)	15.9	3.45	16.1	2.45	> 0.05	Insignificant
TPC (x 10 ³ /µl)	217.75	140.8	223	156.7	> 0.05	Insignificant

- TLC – Total Lymphocyte Count
- ANC – Absolute Neutrophil Count
- ALC – Absolute Lymphocyte Count
- AMC – Absolute Monocyte Count
- AEC – Absolute Eosinophil Count
- ABC – Absolute Basophil Count
- Hb% - Hemoglobin Percentage
- PCV – Packed Cell Volume
- MCV – Mean Corpuscular Volume
- MCH – Mean Corpuscular Haemoglobin
- MCHC – Mean Corpuscular Hemoglobin Concentration
- RDW – Red Blood Cell Distribution Width
- TPC – Total Platelet Count

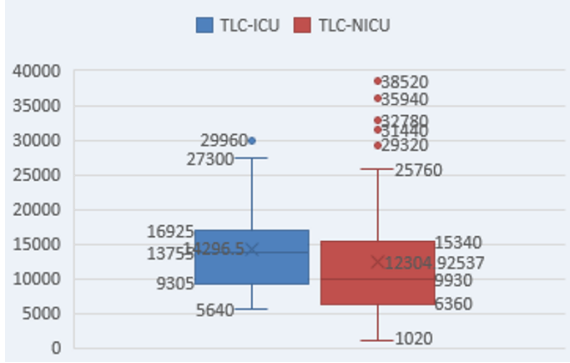


Chart 4a: TLC Statistics

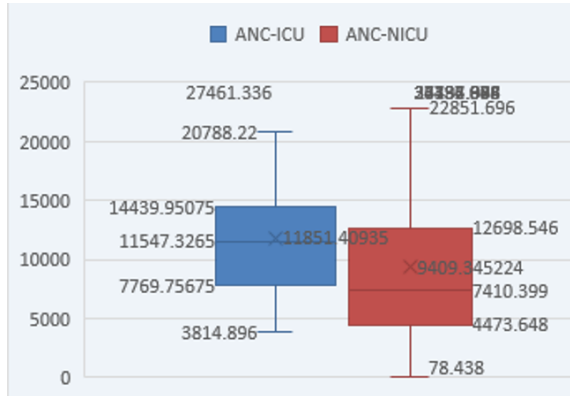


Chart 4b: ANC Statistics

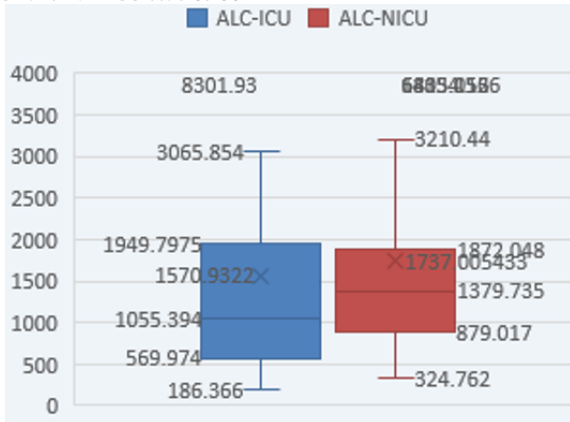


Chart 4c: ALC Statistics

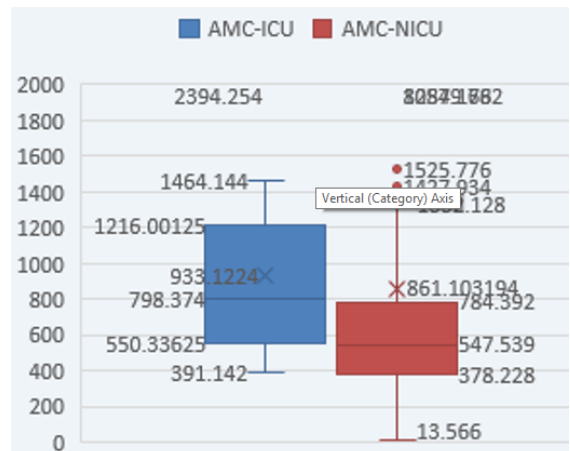


Chart 4d: AMC Statistics

Median Values, Interquartile Range (IQR) and Mann-Whitney

U test were calculated for Hematological Laboratory Parameters viz. TLC, ANC, ALC, AMC, AEC, ABC, Hb%, PCV, MCV, MCH, MCHC, RDW and TPC (Table 4). On comparison of Total Leucocyte Count (TLC) in ICU vs Non-ICU groups showed statistically marginally insignificant ($p = 0.0537$) but clinically significant values (Median value -13755 vs 9930, IQR - 7620 vs 6670.193) & both values were higher than Median Normal Reference Value (NRV).^[9,10] Similar trend for ICU & Non-ICU groups were seen for Absolute Neutrophil Count (ANC - Median Value - 11547.33 vs 7410.339, IQR - 6670.193 vs 8224.902, p -value < 0.05) and Absolute Monocyte Count (AMC - Median Value - 798.374 vs 547.539, IQR - 665.6647 vs 406.164, p -value < 0.05) respectively. In contrast, Absolute Lymphocyte Count (ALC) showed reverse decreasing trend which were statistically insignificant ($p = 0.145$, > 0.05) but clinically significant values (Median values 1055.394 vs 1379.735, IQR - 1379.824 vs 993.031) in ICU & Non-ICU group respectively, however both values falls under ALC NRV.^[9,10] The p -values for rest parameters were insignificant except MCHC.

DISCUSSION:

The present study was an attempt to identify the Haematological Parameters associated with the COVID19 disease and its severity. Total 87 RT-PCR positive patients were admitted in our Hospital during the study period, of which 67 patients (77%) presented with No Symptoms or only Mild Symptoms requiring only General Nursing Care whereas 20 patients (23%) presented with more Serious Symptoms requiring ICU Care. It is in concordance with study of Wang D et al^[11] who studied 138 hospitalized patients and found 26% patients requiring ICU care. Mean age of presentation is 41.2 years (Range:13-81 years) in our study which correlated exactly with the study by Mardani R et al^[4] 41.3 years (Range:19-78 years). On further division, Mean Age of presentation is 52 years (Range:27-81 years) for ICU group while 38 years (Range:13-72 years) in Non-ICU group (14 years difference) implying that elderlies are more prone to land in ICU than young patients. On observing Age wise Distribution Pattern, younger peoples presented with No symptoms or Mild symptoms whereas more aged peoples > 40 years presented with more Severe symptoms and required special ICU care. Surprisingly women of 21-30 years were maximum in numbers, but most of them were asymptomatic or only mildly symptomatic. Regarding ICU admittance, Age along with Comorbidity like Diabetes Mellitus, Hypertension, Obesity, Bronchial Asthma etc. played significant roles. In the present study, we found COVID19 infection has no predilection towards gender and infects both sexes equally. In fact, in our study Females were more in numbers ($n=45, 51.7%$) than Males ($n= 42, 48.3%$) contrasting the other studies where Males were numerous than Females.

On evaluation of Haematological Parameters, we found that TLC, ANC and AMC were significantly higher in ICU group than Non-ICU group but both values were still higher than Median NRV. It implies that COVID19 infection leads to increased TLC, ANC & AMC than normal. In contrast, ALC showed reverse trend in which Median value in ICU group decreased than Non-ICU group, however the values were still under ALC NRV.^[9,10] We hypothesize that increasing values of TLC, ANC & AMC &/or decreasing values of ALC on serial testing are better signs of clinical deterioration than a single test value. All other Haematological parameters viz. AEC, ABC, Hb%, PCV, MCV, MCH, RDW & TPC showed insignificant statistical difference ($p > 0.05$) except MCHC ($p < 0.05$). But, abnormality of these Parameters and its corrections are of vital importance for recovery and hence must be carefully evaluated for each of them.

CONCLUSION:

Mean age of Hospitalization in COVID19 disease is 41.2 years (± 15.5 , $n=87$) with ICU admission at 52 years (± 13.9 , $n=20$) and Non-ICU admission at 38 years (± 14.4 , $n=67$). Severity of

COVID19 disease increases with senility and co-morbidities while high and/or increasing Total Leucocyte Count (TLC), Absolute Neutrophil Count (ANC), Absolute Monocyte Count (AMC) & low and/or decreasing Absolute Lymphocyte Count (ALC) are the most important Haematological Parameters for COVID-19 diagnosis, severity assessment, prognosis and management. Statistically significant differentiation was not observed for other vital Haematological Parameters viz. Hb % estimation, Packed Cell Volume, Red Blood Cell Indices & Platelet Count (PC) in differentiating between Non-ICU & ICU admission however abnormal values needs correction for proper disease management.

CONFLICT OF INTEREST: None

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