



BLOOD COUNTS TRENDS AND PATIENT OUTCOMES IN PATIENTS OF MODERATE TO SEVERE COVID-19 DISEASE

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ABSTRACT

Introduction: COVID-19 pandemic has disrupted whole health care system and economy. The disease severity ranges from asymptomatic to fatality. Hematological parameters like total leucocyte count (TLC) and others have been correlated with the severity of disease progression. **Method:** After obtaining institutional ethical clearance, an observational study was conducted in 99 confirmed COVID-19(RTPCR) patients aged between 20 to 80 years admitted to the ICU. All the haematological parameters were collected from the time of ICU admission till the recovery/death of the patient. Primary objective included correlation of the haematological parameters with the outcome at the time of admission to ICU and at the time of discharge or death. Descriptive statistics like percentage, mean was used and inferential statistics like student t test was used to find out the association between parameters and the outcome. **Results:** Mean age of the patients was 55.98 ± 12.75 years, 72.7% of them were males and 27.3% were females. A statistically significant association was observed between haematological parameters like TLC(P-0.000), lymphocytes(P-0.009), NLR(P-0.012) and the outcome, at the time of death and discharge. However there was no statistically significant association between the same parameters with the outcome at time of admission. **Conclusion:** Hematological parameters does play a role in assessing the prognosis of COVID-19 disease.

KEYWORDS : COVID 19, Neutrophil to lymphocyte ratio, Total leucocyte count, platelet counts

INTRODUCTION

COVID 19/SARS COV2, a novel beta corona virus was first found to be the cause for severe acute respiratory syndrome in Wuhan, China in December 2019.¹ COVID 19 is highly contagious viral disease with high propensity to respiratory tract. It is transmitted from human to human through respiratory droplets and contact. Manifestations vary from asymptomatic to severe acute respiratory illness to even deaths. Most cases remain asymptomatic. Around 80.9% of Patients will have mild symptoms and about 13.8% severe pneumonia, 4.7% respiratory failure, multiorgan failure and 3% of these are fatal.² The disease severity is more in elderly patients with underlying comorbid conditions. Thus, the disease has disrupted whole health care system and economy across the globe. The disease has unpredictable course and evolution.

The pathogenesis of COVID-19 has been analysed to be complex with multi-system involvement including hematopoietic system, Respiratory system and immune system. Also, there are formidable evidences suggesting the features of hyper inflammation in critically ill patients, consisting of elevated serum C-reactive protein (CRP), procalcitonin, D-Dimer and hyperferritinemia.^{3,4}

A significant positive clinical correlation has been observed with neutrophilia, lymphocytopenia, eosinopenia, thrombocytopenia.⁵ The neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR) have both been emerged as better indicators of subclinical systemic inflammation in many diseases like cardiovascular diseases, cancers, autoimmune diseases and also in COVID-19. Whereas few researches have observed the strong correlation between lymphopenia with the disease severity.^{5,6}

Thus, to obtain a clearer picture of this emerging data, the present study had been undertaken to evaluate the blood count trends in the outcome of COVID 19 patients admitted to Dedicated COVID-19 Hospital (DCH) ICU, Ballari.

OBJECTIVES

Primary objective:

To study correlation of total leukocyte count (TLC) with the outcome

Secondary objective:

To study correlation of lymphocytes, neutrophils to lymphocytes ratio (NLR) and platelet counts with the outcome

MATERIALS AND METHODOLOGY

We had conducted the present retrospective study by including the

patient's data of either gender, aged between 20 to 80 years diagnosed with COVID-19 on RTPCR with moderate to severe symptoms, admitted to DCH ICU, Ballari.

Study subjects were included till the end of the pandemic. Patients who were not willing to give consent were excluded from the study.

Study was conducted after obtaining the clearance from Institutional Ethics committee. After obtaining written informed consent, Covid 19 patients admitted in ICU were assessed. The detailed clinicodemographic features, clinical manifestations and laboratory parameters like TLC, neutrophils, lymphocytes, NLR, platelet counts, haemoglobin and other serum biomarkers were noted at the time of admission.

All these laboratory parameters were repeated according to the set guidelines by state government and sometimes as per need.

The blood counts trend of all patients were followed from the time of admission to ICU to till the improvement in symptoms and signs, improvement in biomarkers, requirement of various Oxygen therapy, discharge from ICU or death. All the above-mentioned parameters were assessed between the patients discharged and the patients died.

Statistical Analysis

All the collected data was stored in MS Excel 2010. Data analyzed with SPSS Version 20.0[®] software using the suitable statistical method. Chi-square test for categorical data and Student-t test for the continuous data were applied. P value of 0.05 is considered as significant.

RESULTS

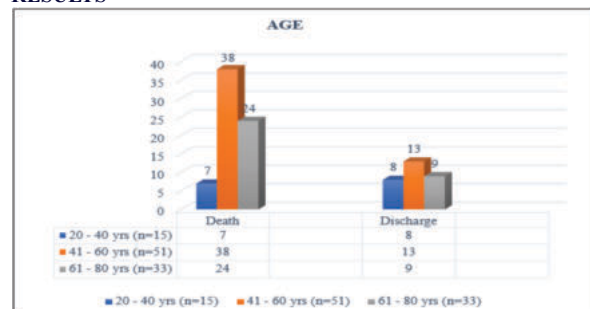


Figure 1: Age wise distribution of study sample

The obtained results are expressed as the tables and graphs as below;
Based on the obtained data,

Mortality was found to be higher among the patients aged 60 years and above but there was no statistical association proved between the age with respect to the outcome.

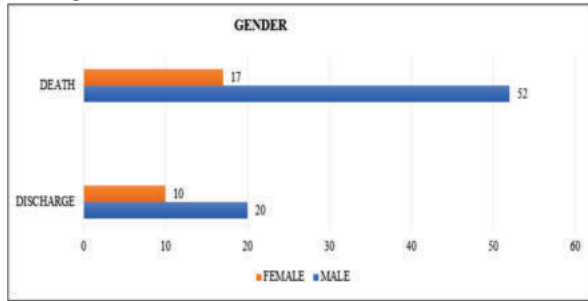


Figure 2: Distribution Of Gender Based On The Outcome
p 0.372

Distribution of gender among the two groups was not significant.

Table 1: Distribution of Comorbid conditions between the death and discharge patient group

Positive history of comorbid conditions: Total number of cases	Death		Discharge		P value
	Frequency	Percent	Frequency	Percent	
Hypertension: 40	26	65.0	14	35.0	0.402
Diabetes mellitus: 34	25	73.5	9	26.5	0.548
Renal failure: 6	4	66.7	2	33.3	0.868
Hypothyroidism: 1	1	100.0	0	0.0	1.00
Ischaemic heart disease: 4	3	75.0	1	25.0	1.00

Although the number of patients with comorbid conditions were high among the death group, we could observe that there was no statistical correlation or association was observed between the comorbid conditions and the outcome.

Table 2: Comparison of hematological parameters among the outcome groups at admission

PARAMETER	Death	Discharge	t statistics	p value
	Mean±SD	Mean±SD		
TLC	10621.74±4835.28	9876.67±5150.34	-0.691	0.491
Lymphocytes	9.42±8.35	8.92±5.71	-0.296	0.768
NLR	16.02±20.79	12.32±6.72	-0.950	0.345
Platelet counts	2.83±1.42	2.93±1.33	0.320	0.749

The above table explains the distribution of various hematological parameters between the two outcome groups at the time of Admission. There was neither any clinical nor biochemical correlation observed.

Table 3: Comparison of hematological parameters among the outcome groups at discharge/death

Haematological parameters	Death	Discharge	t statistic	P value
	Mean ± SD	Mean± SD		
TLC	14828.99±6449.38	9670.00±4515.50	-3.973	0.000
Lymphocytes	7.40± 7.71	12.15± 9.10	2.669	0.009
NLR	26.98± 29.21	12.86± 11.65	-2.555	0.012
Platelet counts	2.93± 2.45	3.15± 1.32	0.464	0.644

From the above table, we can observe that the TLC and NLR were significantly higher among death group with the p value of 0.000 and 0.012 respectively. Whereas the lymphocyte count was significantly lower among the death group with the p value of 0.009. There was no significant association between the platelet counts with the outcome as per the above table.

DISCUSSION

As we mentioned earlier, Covid 19 was one of the deadliest, highly contagious viral disease with high propensity to respiratory tract. The disease severity was observed to be more among elderly patients with underlying comorbid conditions like Diabetes mellitus, hypertension,

obesity and other immunocompromised states such as cancers. The course and evolution of the disease still remains unpredictable. Based on the available evidences, various hematological parameters were correlated with severity of the disease progression. Thus, to obtain a clearer picture of the emerging data, this study has been undertaken.

We had defined the parameters based on the standard laboratory guidelines. Leucocytosis was defined if the TLC >11000cells/mm³, Leucocytopenia if the TLC <4000cells/mm³, Lymphocytosis when the Lymphocyte count is >40%, <20% considered as Lymphocytopenia. NLR ratio considered to be normal if it is between 1 to 3 above which indicates the severe form of COVID 19, platelet count >4 lakhs/cumm and <1 lakh/cumm were considered as the thrombocytosis and thrombocytopenia.

On analysis, we observed that the mortality rate was higher among the patients aged above 40 years. The mortality rate was 74.5% (38/51) of the overall patients aged between 41 to 60 years and 72.7% (24/33) between 61 to 80 years. There was no correlation between the age, gender of the patients and the outcome. Like our observation, **Zanwar PP et al** had mentioned that as per the Ministry of Health and Family Welfare statistics, age-wise mortality due to COVID 19 was approximately 50% among the patients aged more than 60 years.⁷ Also, they analysed that 46% of the patients died due to COVID were females.

In our study, TLC and NLR were significantly higher among death group with the p value of 0.000 and 0.012 respectively. **Reusch N et al** in their article have explained the increase in neutrophil count and its positive association with increased severity of the disease.⁸ Our outcome was in consistence with **Bairwa M et al**, who had reported the significantly increased TLC among non-survival group of patients.⁹

Also, we observed the incidence of lymphocytopenia being 78.26% and 50% among the patients in dead group and those who discharged respectively. Even **Bairwa M et al**, also found significant positive association between mortality and lymphopenia.⁹ Similarly, **Lai KL et al** interpreted that Lymphocyte counts will be the most reliable predictors of severity of the COVID 19, including mortality.¹⁰

Incidence of patients with NLR >10 at the time of admission was 68.4% in death group whereas 31.6% among the patients who got discharged. Similarly, the incidence of patients with NLR >10 at the time of discharge/death was 78.3% and 21.7% among death and discharged groups respectively. Whereas the lymphocyte counts were significantly lower among the death group with the p value of 0.009.

Similar to our finding, another retrospective hospital-based study by **Marimuthu AK et al** also had observed significantly increased NLR as the disease worsened.¹¹ Even **Imran MM et al** reported that the NLR and CRP was positively correlated with the severity, p value of 0.04.¹² **Sakthivadivel V et al** who had conducted the similar clinical research also had observed increased inflammatory markers which was significantly higher among non survivors than survivors as observed in the present study.¹³ **Jing Liu et al** is another research outcome which has been identified NLR as powerful prognostic parameter.¹⁴

We did not find any kind of association between the platelet count and the outcome. Unlike our observation, **Giuseppe Lippi et al** had reported the strong positive correlation between the severity of the disease and thrombocytopenia.

CONCLUSION

We conclude that leucocytosis, lymphopenia, high NLR may serve as predictors of disease severity and disease progression in COVID-19 patients and enhancing cellular immunity may contribute to COVID-19 treatment.

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