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Neutrophil Lymphocyte Ratio (NLR) as a Prognostic Marker of Patients with COVID-19

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ABSTRACT

COVID-19 infections have caused millions of deaths around the world. This study gives a detailed insight into the demographic and clinico-laboratory profile of deaths among COVID-19 patients admitted in a tertiary care COVID hospital. The present study was done to evaluate prognostic role of NLR in COVID-19 positive patients for early identification and grading of symptomatic patients who might need critical care support. The present retrospective observational study on 96 symptomatic patients was carried out in KPC Medical College and Hospital, Jadavpur comparatively assessing laboratory investigations. Medical records of 96 COVID-19 positive patients were studied. The mean age of the study population was 55.5±13.7 years for Females and 58.2±13.9 for Males ranging from 20-89 years. The majority (53.31%) were in the age group of 50-69 years. Significant association was found between high NLR and covid-19 death. An early admission and optimal management during the initial period of COVID 19 disease is critical and may help in decreasing the mortality. Neutrophil Lymphocyte Ratio (NLR) as a promising prognostic indicator in COVID 19 positive patients, demonstrating a significant association between NLR>5.0 at admission and in hospital mortality.

INTRODUCTION

The novel corona virus 2019-nCoV or COVID-19 has infected people all over the world in a short span of time. On March 11, 2020, WHO declared COVID-19 as a pandemic. There have been about 609 million confirmed COVID-19 cases with over 6.5 million deaths globally[1]. Around 5.2 lakh deaths occurred due to this pandemic in India and about 26,499 deaths have been reported in the capital city of New Delhi[2]. COVID-19 has a varied spectrum of presentation ranging from asymptomatic cases to severe pneumonia to acute respiratory distress syndrome (ARDS) with multiple organ failure and death. In a study from China by Wang *et al.*[3] the major cause of death in COVID-19 patients was found to be acute respiratory failure and sepsis. On one hand, the case fatality ratio (CFR) has been quite high in some countries like Yemen (18%), Sudan (7.84%), Syria (5.53%), Somalia (5%) and Mexico (4.7%), on the other some countries have very low CFR such as Bhutan (0.03%), Singapore (0.09%) and New Zealand (0.11%). Among the countries with maximum confirmed cases, India has a CFR of about 1.1% compared to Russia (1.88%), Brazil (1.98%), USA (1.1%) and global CFR of 1% 1. This variation in mortality rates has been postulated to be due to various factors such as racial differences, population age composition, health facilities availability, hospitalisation criteria and local administrative policies[4].

It has been observed that lymphopenia, high NLR (Neutrophil lymphocyte ratio), raised dimer and high C-reactive protein (CRP) are poor prognostic factors in COVID-195. However, there is a relative lack of literature on demographic, clinical and other laboratory factors associated with the disease severity and mortality in COVID-19. Hence, the present study was conducted to identify the same.

MATERIALS AND METHODS

This retrospective observational study was conducted at Department of General Medicine of a dedicated tertiary level COVID-19 care hospital of Kolkata, India. The medical records of COVID-19 positive deaths during the period of one month from 1st April 2021-30th April 2021 were retrieved after obtaining Institutional Ethics Committee approval. All adult patients (>18 years of age) who were admitted and died with confirmed COVID-19 infection (confirmed by positive reverse transcriptase polymerase chain reaction (RTPCR) or cartridge based nucleic acid amplification test (CBNAAT) or rapid antigen test (RAT) of nasopharyngeal/oropharyngeal swab) were included in the study. The data including age, gender, Neutrophil Count, Lymphocyte Count, Neutrophil-Lymphocyte Ratio, Survival of patients were recorded as per the study proforma.

Software-jamovi desktop, os-windows version 2.3.28 (India) software was used for statistical analysis. All quantitative variables were expressed as Mean±Standard Deviation and Median. Qualitative variables were expressed as proportion. The Cox proportion analysis was applied to identify the significant risk factors.

RESULTS

Over a period of one month, from 1st April 2021-30th April 2021, 100 patients with COVID-19 positive report were admitted in COVID wards/Intensive care units (ICU) of our hospital. The medical records of 14 COVID-19 positive deaths during this period were retrieved from the medical records section and data collected from case records was subsequently analysed.

Among the 14 COVID-19 positive deaths observed, 5 (35.7%) were males and 9 (64.3%) were females. The mean age of the study population was 55.5±13.7 years for Females and 58.2±13.9 for Males ranging from 20- 89 years. The majority (53.31%) were in the age group of 50-69 years (Table 1).

The mean NLR ratio (N = 96) was 7.18±5.7 for Females and 6.57±5.54 for Males. Around 54.16% patients (52/96) had NLR>5.0 at the time of admission (Table 2 and Fig. 1).

The cut-off of NLR>5.0 was taken as it was found to be associated with high in-hospital mortality for COVID- 19. Among 96 patients, 30 patients (31.30%) had NLR range of (5-9.9). 23 patients among 30 patients who have NLR range (5-9.9) were discharged (76%). About 6 patients among 30 patients who have NLR range (5-9.9) had expired (20%). For 5 among 8 patients (62%) who have NLR range (15-19.9) had expired. About 40 among 44 patients (91%) who have NLR range (1-4.9) were discharged (Table 3 and 4).

DISCUSSIONS

This retrospective study provide valuable insights into the prognostic role of the Neutrophil Lymphocyte Ratio (NLR) in COVID-19 positive patients admitted to our hospital's COVID wards/Intensive Care Units (ICU) during a one-month period. The study found a significant association ($p<0.001$) between NLR and in-hospital mortality for COVID-19 patients.

Specifically, patients with NLR>5.0 at the time of admission had a higher risk of mortality. This suggests that NLR can serve as a potential prognostic marker for assessing disease severity and outcomes in COVID-19

Tables 1: Age and Gender

Descriptives	Sex	Age
N	F	53
	M	43
Mean	F	55.5
	M	58.2
Minimum	F	21
	M	26
Maximum	F	89
	M	87

Table 2: Neutrophil×Lymphocyte

	Sex	Age	Neutrophil	Lymphocyte	NLR
N	F	53.0	53.0000	53.00	53.0
	M	43.0	43.0000	43.00	43.0
Mean	F	55.5	0.7890	0.169	7.18
	M	58.2	0.7760	0.178	6.57
95% Cl mean lower bound	F	51.8	0.7560	0.141	5.61
	M	53.9	0.7440	0.150	4.86
95% Cl mean upper bound	F	59.3	0.8170	0.198	8.75
	M	62.4	0.8080	0.207	8.28
Standard deviation	F	13.7	0.1100	0.104	5.70
	M	13.9	0.1050	0.0920	5.54
Variance	F	188	0.0121	0.0108	32.5
	M	193	0.0110	0.00846	30.7

Table 3: Contingency tables

	OUTCOME				
NLR range	Discharge	DORB	Expired	LAMA	Total
01-4.9	40	1	1	2	44
05-9.9	23	1	6	0	30
10-14.9	9	0	1	1	11
15-19.9	3	0	5	0	8
20-24.9	0	0	0	2	2
30-34.9	0	0	1	0	1
Total	75	2	14	5	96

Table 4: X^2 test

X^2 test	Value	df	p-value
X^2	65.9	15	<0.001
N	96		

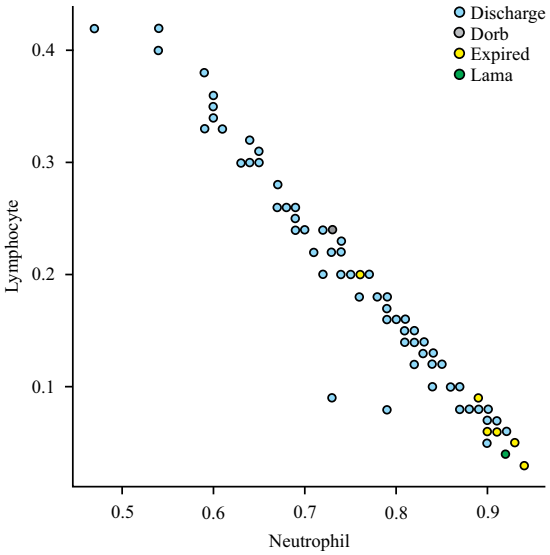

Fig. 1: Neutrophil×Lymphocyte

cases. The analysis revealed that among the observed COVID-19 positive deaths, a higher percentage of females (64.3%) succumbed to the disease compared to males (35.7%). The reasons behind this gender disparity warrant further investigation and may have implications for tailoring treatment strategies based on sex-specific factors. The majority of COVID-19 positive deaths occurred in the age group of 50-69 years[5].

Additionally, the mean NLR was higher in the older age groups. This highlights the importance of considering age as a significant factor when assessing the prognostic value of NLR[6].

CONCLUSION

This retrospective study underscores the potential of the Neutrophil Lymphocyte Ratio (NLR) as a promising prognostic indicator in COVID-19 positive patients, demonstrating a significant association between NLR>5.0 at admission and in-hospital mortality. Further validation through large-scale prospective studies is warranted to harness NLR's predictive utility and enhance risk stratification for better COVID-19 patient management.

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