

A CROSS SECTIONAL STUDY OF NEUTROPHIL-LYMPHOCYTE RATIO (NLR) AS AN INDICATOR OF DISEASE SEVERITY AND PROGNOSTIC MARKER AMONG PATIENTS WITH COVID-19 INFECTION IN A TERTIARY CARE CENTER

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Abstract

Background: Corona virus disease 2019 (COVID-19) is an acute respiratory tract infection caused by the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). The main routes of transmission of this highly contagious virus include respiratory droplets and close contact. The SARS-CoV-2 infection is associated with a wide range of clinical symptoms, including asymptomatic, non-severe and severe forms, which can rapidly lead to death. **Materials and Methods:** This was a cross-sectional type of study. The study was conducted during the period from May 2020 to September 2020. The study was conducted in Department of Pathology, Govt General and Chest Hospital/Osmania Medical College, Hyderabad. A total 132 patients diagnosed with SARI who were admitted in hospitals attached to OMC were included in the study. History was taken, general physical examination and a detailed systemic examination was done. Patients were categorized into moderate and severe illness according to WHO clinical criteria. RT-PCR for all patients was done using throat and nasal swab. Total WBC counts and differential counts, platelet counts were estimated. **Result:** The study was conducted on 132 patients diagnosed with SARI, of which 67 were COVID-19 positive patients and 65 were COVID-19 negative. Mean age of subjects with COVID-19 positive (severe) was higher 58.70±15.596 Severity followed by COVID-19 positive (moderate) 55.13±14.480 [Table 1]. **Conclusion:** NL ratio was higher in patients with COVID-19 positive SARI as compared to COVID-19 negative SARI. There was significant correlation between increase in NL ratio and disease severity of COVID-19 positive pneumonia. We found that increase in NL ratio was associated with comorbidities like diabetes mellitus and hypertension.

INTRODUCTION

Corona virus disease 2019 (COVID-19) is an acute respiratory tract infection caused by the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). The main routes of transmission of this highly contagious virus include respiratory droplets and close contact.^[1] The SARS-CoV-2 infection is associated with a wide range of clinical symptoms, including asymptomatic, non-severe, and severe forms, which can rapidly lead to death.^[2] Current evidence regarding COVID-19 pneumonia suggests that there may be an imbalance in the immune response that leads to high levels of inflammation in patients with severe pneumonia. Therefore,

laboratory parameters must be considered to diagnose COVID-19 and categorize patients as having non severe or critical disease, to plan the appropriate treatment and reduce mortality.^[3] Initially the disease started with zoonotic transmission but soon it occurred to spread through human to human transmission. Transmission of the virus causing COVID-19, i.e. SARS-CoV-2 was considered to be via droplets rather than aerosols but strong directional airflow may support the spread by droplet up to more than 2 meters.^[4] Clinical spectrum of COVID-19 ranges widely including asymptomatic infection, self-limiting mild upper respiratory tract infection, severe pneumonia, ARDS, MODS and even death. The WHO has officially declared COVID-19 as a pandemic and all the countries are

facing difficulties in controlling and treating the disease.² There is a need for reliable indicator to assess the severity of the disease.^[5]

NL ratio is shown to be good predictor of mortality in hospitalized patients with community acquired pneumonia. It is cheaper and easier to perform the test. NL ratio is an indicator of systemic inflammatory response. Many previous studies have shown NL ratio to be good prognostic marker for COVID-19 pneumonia.^[6]

However, correlation of NL ratio with severity of COVID-19 pneumonia is less studied and this study intends on comparison of NL ratio in COVID-19 SARI and non-COVID-19 SARI and correlation of the same with severity of the disease.

MATERIALS AND METHODS

This was a cross-sectional type of study. The study was conducted during the period from May 2020 to September 2020.

The study was conducted in Department of Pathology, Govt General and Chest Hospital/ Osmania Medical College, Hyderabad.

Inclusion Criteria

Patients/attenders willing to give informed consent, patients of either sex with age more than 18 years and patients admitted in COVID-19 suspect hospital and diagnosed with SARI were included in the study.

Exclusion Criteria

Patient not willing to give informed consent and patients with age less than 18 years were excluded from the study.

Methodology of Data Collection

A total 132 patients diagnosed with SARI who were admitted in hospitals attached to OMC were included in the study. History was taken, general physical examination and a detailed systemic examination was done. Patients were categorized into moderate and severe illness according to WHO clinical criteria. RT-PCR for all patients was done using throat and nasal swab. Total WBC counts and differential counts, platelet counts were estimated. NL ratio were correlated with pneumonia severity and compared

between COVID-19 positive and negative SARI and also correlation with co-morbidities was done.

WHO Criteria for Categorizing the Patients

Mild Disease

Symptomatic patients with ILI symptoms without evidence of viral pneumonia or hypoxia were categorized as mild.

Moderate Disease

Adolescent or adult with clinical signs of pneumonia (fever, cough, dyspnoea, fast breathing) but no signs of severe pneumonia, including SpO₂ ≥90% on room air were categorized as moderate.

Severe Disease

Adolescent or adult with clinical signs of pneumonia (fever, cough, dyspnoea, fast breathing) plus one of the following like respiratory rate >30 breaths/min, severe respiratory distress or SpO₂ <90% on room air was categorized as severe.

Statistical Analysis

Data was analyzed by descriptive statistics. Chi square test used to see association between qualitative variables and correlation co-efficient was used to see relation between quantitative variables. P<0.05 was considered statistically significant. Independent sample test was applied for quantitative variables between COVID-19 positive and COVID-19 negative subjects.

RESULTS

The study was conducted on 132 patients diagnosed with SARI, of which 67 were COVID-19 positive patients and 65 were COVID-19 negative. Mean age of subjects with COVID-19 positive (severe) was higher 58.70±15.596 Severity followed by COVID-19 positive (moderate) 55.13±14.480 (Table 1).

Number of patients above 65 years 40 (30.2%) was higher followed by age group of 36 to 45 years 26 (19.2%). Chi square test was applied to associate the age with severity. Chi square test showed statistically significant association with respect to age (Table 2). In our study males were higher 87 (65.7%) as compared to females 45 (34.3%). Chi square test was applied to associate the gender with severity. Chi square test showed no statistical significant association with respect to gender

Table 1: Distribution of mean age

Covid -19	Severity	N	Minimum	Maximum	Mean	SD
Negative	Moderate	35	21	85	46.80	17.15
	Severe	30	20	92	52.52	15.92
Positive	Moderate	27	24	79	55.10	14.10
	Severe	40	23	95	58.21	15.12

Table 2: Distribution of age among the groups

Age (in years)		Covid-19 Negative		Covid-19 Positive		Total
		Moderate	Severe	Moderate	Severe	
Less than 25 years	N (%)	6	2	1	2	11
26-35	N (%)	4	3	3	3	13
36-45	N (%)	11	6	4	4	25
46-55	N (%)	3	6	6	5	20
56-65	N (%)	5	5	4	10	24

Above 65	N (%)	6	8	9	16	39
Total	N (%)	35	30	27	40	132

Table 3: Distribution of mean NL Ratio.

Covid-19	Severity	N	Minimum	Maximum	Mean	SD
Negative	Moderate	35	0.68	46.00	5.90	7.80
	Severe	30	1.51	46.32	7.20	7.17
Positive	Moderate	27	0.89	25.40	8.86	6.10
	Severe	40	1.92	45.80	15.90	10.27

Table 4: Comparison between COVID-19 negative and COVID-19 positive groups using independent sample t test.

Comparison	COVID-19 negative versus COVID-19 positive	
	Mean difference	P value
NL ratio	-6.62	0.00

Table 5: Comparison between moderate and severe subgroups using independent sample t test

Comparison		Moderate versus severe	
		Mean difference	P Value
COVID 19 negative	NL Ratio	-1.28	0.33
COVID 19 positive	NL Ratio	-6.96	0.00

DISCUSSION

In our study, demographic characteristics of the study subjects showed males were higher, 87 (65.7%) as compared to females, 91 (34.3%) which was similar to Zhou et al having majority male subjects and Mousavi-Nasab et al where 57.1% were males. Tatum et al cited females to be majority in their study. Turk Thorac J studied 204 patients of which 115 were COVID-19.^[7]

positive SARI with majority male (67.8%) patients and of 99 COVID-19 negative patients also male (62%) patients were more than female.^[8]

In the present study mean age of subjects with COVID-19 positive (severe) was higher, 58.70±15.58 followed by COVID-19 positive (moderate) 55.13±14.40, distribution of subjects based on age showed subjects above 65 years, 40 (30.2%) was higher followed by age group of 36 to 45 years, 25 (19.2%). According to Nalbant et al study, the mean age (SD) was 26 (18) years for COVID-19 positive patients and 30 (14) for COVID-19 negative patients, with difference being not statistically significant, also no significant difference between gender distribution. In the study by Mousavi-Nasab et al they studied patients with the mean age of 42.7±12.4 (ranging from 19 to 78) years of them 40.2% being in the age range of 30 to 49 years. They also cited that 20% cases had severe disease where as 80% were non severe cases. In the study by Turk Thorac J et al mean age for COVID-19 positive was 51.8 years and that of COVID-19 negative was 51.3 years. In the study by Mon et al age for severe COVID-19 was higher as compared to mild cases (67.9±12.3 versus 53.2±15.6).^[9]

In our study we found that higher value of NL ratio was associated with more severe COVID-19 disease, similarly Yan et al study showed that NL ratio was higher in non-survivor group of COVID-19 patients which was significantly associated with all cause in hospital mortality. Liu et al found that NL ratio more

than 3.13 was independent risk factor for progression to critical illness in patients with COVID-19.^[10]

CONCLUSION

NL ratio was higher in patients with COVID-19 positive SARI as compared to COVID-19 negative SARI. There was significant correlation between increase in NL ratio and disease severity of COVID-19 positive pneumonia. We found that increase in NL ratio was associated with co-morbidities like diabetes mellitus and hypertension.

REFERENCES

- Mousavi-Nasab SD, Mardani R, Nasr Azadani H, Zali F, Ahmadi Vasmehjani A, Sabeti S, et al. Neutrophil to lymphocyte ratio and C-reactive protein level as prognostic markers in mild versus severe COVID-19 patients. *Gastroenterol Hepatol Bed Bench.* 2020;13(4):361-366.
- Garg PK, Khera PS, Saxena S. Chest-X-ray-Based Scoring, Total Leukocyte Count, and Neutrophil-to-Lymphocyte Ratio for Prediction of COVID-19 in Patients with Severe Acute Respiratory Illness. *Turk Thorac J.* 2021;22(2):130-6.
- Nalbant A, Kaya T, Varim C, Yaylaci S, Tamer A, Cinemre H. Can the neutrophil/lymphocyte ratio (NLR) have a role in the diagnosis of coronavirus 2019 disease (COVID-19)? *Rev Assoc Med Bras* (1992). 2020;66(6):746-751. doi: 10.1590/1806-9282.66.6.746.
- Kong M, Zhang H, Cao X, Mao X, Lu Z. Higher level of neutrophil-to-lymphocyte is associated with severe COVID-19. *Epidemiol Infect.* 2020;148:e139. doi: 10.1017/S0950268820001557.
- Eslamijouybari M, Heydari K, Maleki I, Moosazadeh M, Hedayatizadeh-Omran A, Vahedi L, et al. Neutrophil-to-Lymphocyte and Platelet-to-Lymphocyte Ratios in COVID-19 Patients and Control Group and Relationship with Disease Prognosis. *Caspian J Intern Med.* 2020;11(Suppl 1):531-535. doi: 10.22088/cjim.11.0.531.
- Yang AP, Liu JP, Tao WQ, Li HM. The diagnostic and predictive role of NLR, d-NLR and PLR in COVID-19 patients. *Int Immunopharmacol.* 2020;84:106504. doi: 10.1016/j.intimp.2020.106504.
- Chan AS, Rout A. Use of Neutrophil-to-Lymphocyte and Platelet-to-Lymphocyte Ratios in COVID-19. *J Clin Med Res.* 2020;12(7):448-453. doi: 10.14740/jocmr4240.
- Li X, Liu C, Mao Z, Xiao M, Wang L, Qi S, et al. Predictive values of neutrophil-to-lymphocyte ratio on disease severity

- and mortality in COVID-19 patients: a systematic review and meta-analysis. *Crit Care.* 2020;24(1):647. doi: 10.1186/s13054-020-03374-8.
9. Yan X, Li F, Wang X, Yan J, Zhu F, Tang S, et al. Neutrophil to lymphocyte ratio as prognostic and predictive factor in patients with coronavirus disease 2019: A retrospective cross-sectional study. *J Med Virol.* 2020;92(11):2573-2581. doi: 10.1002/jmv.26061.
 10. Liu J, Liu Y, Xiang P, Pu L, Xiong H, Li C, et al. Neutrophil-to-lymphocyte ratio predicts critical illness patients with 2019 coronavirus disease in the early stage. *J Transl Med.* 2020;18:206.