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Original Research Article

Evaluation of simple cost-effective immuno-haematological markers to predict outcome in hospitalized COVID-19 patients during second wave

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ABSTRACT

Background: COVID-19 pandemic has strained the health infrastructure globally, hence the importance of cost-effective biomarkers. We aimed to identify simple haematological prognostic markers in hospitalized COVID-19 patients to differentiate between milder and severe cases, thus predicting outcome.
Methods: A retrospective study of COVID-19 patients admitted at Malla Reddy institute of medical sciences was conducted from April to June 2021. Total leukocyte count (TLC), neutrophil-to-lymphocyte ratio (NLR), derived NLR ratio (dNLR) and platelet-to-lymphocyte ratio (PLR) were calculated and correlated with outcome. These parameters were compared with other inflammatory markers using ROC (receiver operator curve) analysis.
Results: 303 patients of 397 fulfilled the inclusion criteria (male-198, female-105). There was a significant higher mean of NLR in patients with death (14.46±5.84) compared to patients recovered (8.43±4.33), similarly the dNLR was higher in death (8.06±2.34) compared to recovered (4.97±1.49). A significant positive strength of association between the NLR and dNLR with the ESR, CRP, CORADS score and CT severity score in the patients. The ROC analysis showed the NLR (AUC=0.777) and dNLR (0.799) a better marker to predict the outcome.
Conclusions: In COVID-19, immuno-haematological markers like NLR, dNLR, PLR found to be a simple and cost-effective tool to prognosticate the clinical outcome among hospitalized patients and were in concordance with the other inflammatory markers. Hence, these markers serve as better indicators in risk stratification and better management.

Keywords: COVID-19, Haematological markers, NLR, PLR, dNLR

INTRODUCTION

COVID-19 pandemic has strained the health infrastructure globally, hence the importance of cost-effective biomarkers.[1,2] Analyzing haematological markers during hospital admission as well as their applicable thresholds, may be useful tools for clinicians in identifying patients at risk of developing serious disease earlier.[3] Certain researchers have focused on hematological characteristics such as NLR, PLR, red cell distribution width and others, demonstrating that they are guiding tool and predictors of outcome in COVID-19 patients.[4,5] We aimed to identify simple haematological prognostic markers in hospitalized COVID-19 patients to differentiate between mild and severe cases, to predict the outcome.

METHODS

A hospital based retrospective observational study was conducted at MallaReddy institute of medical sciences, Hyderabad, Telangana between 15 April 2021 to 15 June 2021 during the second wave of COVID-19 pandemic. Total 397 patients admitted at hospital were enrolled in the study. All patients with rapid antigen and RT-PCR positive for COVID-19, admitted to the hospital were included in the

study. Patients with age <18 years, pregnant females, haematological disorders, on renal replacement therapy, malignancies and immunodeficiency states like HIV, organ transplant, chronic steroid use and on any immunomodulators were excluded from study.

All the clinical data, haematological and radiological parameters were obtained from the medical records. TLC, NLR, d-NLR, neutrophil count divided by the result of WBC count minus neutrophil count and PLR were calculated and correlated with outcome. These parameters were compared with other inflammatory markers like erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) to further strengthen their validation as prognostic markers.

Statistical analysis

Data obtained was entered in excel sheet. Continuous variables, NLR, dNLR, PLR, ESR, CRP, CORADS and CTSS were expressed as means±SD. Categorical variables were summarized as frequencies and percentages. Correlation of continuous variables was done using Pearson correlation coefficient. The diagnostic ability of study parameters were derived using ROC. Statistical analyses were performed using SPSS v21. A p value of <0.05 was considered statistically significant.

RESULTS

Of the 397 patients admitted to the hospital, 303 patients fulfilled the inclusion criteria. Of the 303 patients, male preponderance was observed (male-198, female-105). The mean haemoglobin was 14.65±3.65 gm/dl and 13.98±3.55 in recovered and death groups. Despite the mean TLC was normal in both recovered and death group, 9652±1265 cells/cumm and 10653±1432 cells/cumm respectively, the mean ANC was significantly higher in death group (recovered 5878.0±2980.3, death 10140±3957, p<0.05).

There was a significant higher mean of NLR (14.46±5.84) and dNLR (8.06±2.34) in patients with death compared to NLR (8.43±4.33) and dNLR (4.97±1.49) in recovered patients However, we did not find the significant mean difference of PLR (Table 1). There was significant positive strength of association between the NLR and dNLR with the ESR, CRP, CORADS score and CT severity score in the patients (Table 2). The ROC analysis showed the NLR (AUC=0.777) and dNLR (AUC=0.799) a better marker to predict the outcome (Figure 2).

Table 1: Demographic, haematological and radiological data and their association with outcome.

Variables	Recovered	Death	P value
Age (years)	47.03±13.4	51.24±15.3	0.093
Male	164	34	0.296
Female	82	23	
Hemoglobin (gm/dl)	14.65±3.65	13.98±3.55	0.123
TLC (cells /cumm)	9652±1265	10653±1432	0.142
ANC	5878.0±2980.3	10140±3957	0.05*
Lymphocyte count (cells /cumm)	1082.39±608.0	929.93±614.6	0.214
NLR	8.43±2.39	14.46±4.32	0.001**
dNLR	4.97±1.49	8.06±2.34	0.001**
PLR	311.09±180.6	310.08±139.3	0.12
CRP (mg/l)	9.12±3.11	15.2±3.42	0.05*
ESR (mm/1hr)	64.4±27.4	82.2±34.3	0.05*
CORADS	5.1±1.1	5.4±0.5	0.092
CT severity score (CTSS)	11.8±4.6	17.4±4.3	0.001**

*p<0.05 is considered statistically significant; **p<0.001 is considered statistically highly significant.

Table 2: Correlation between haematological and radiological parameters.

Parameters		CORADS	CTSS	ESR
NLR	Pearson correlation	0.053	0.245**	0.188
	Sig.	0.453	0.000	0.052
PLR	Pearson correlation	-0.010	0.128	0.031
	Sig.	0.888	0.072	0.750
dNLR	Pearson correlation	0.104	0.846**	0.505*
	Sig.	0.143	0.000	0.032
ESR	Pearson correlation	0.286**	0.336**	1
	Sig.	0.001	0.000	

**p<0.001 is considered statistically highly significant.

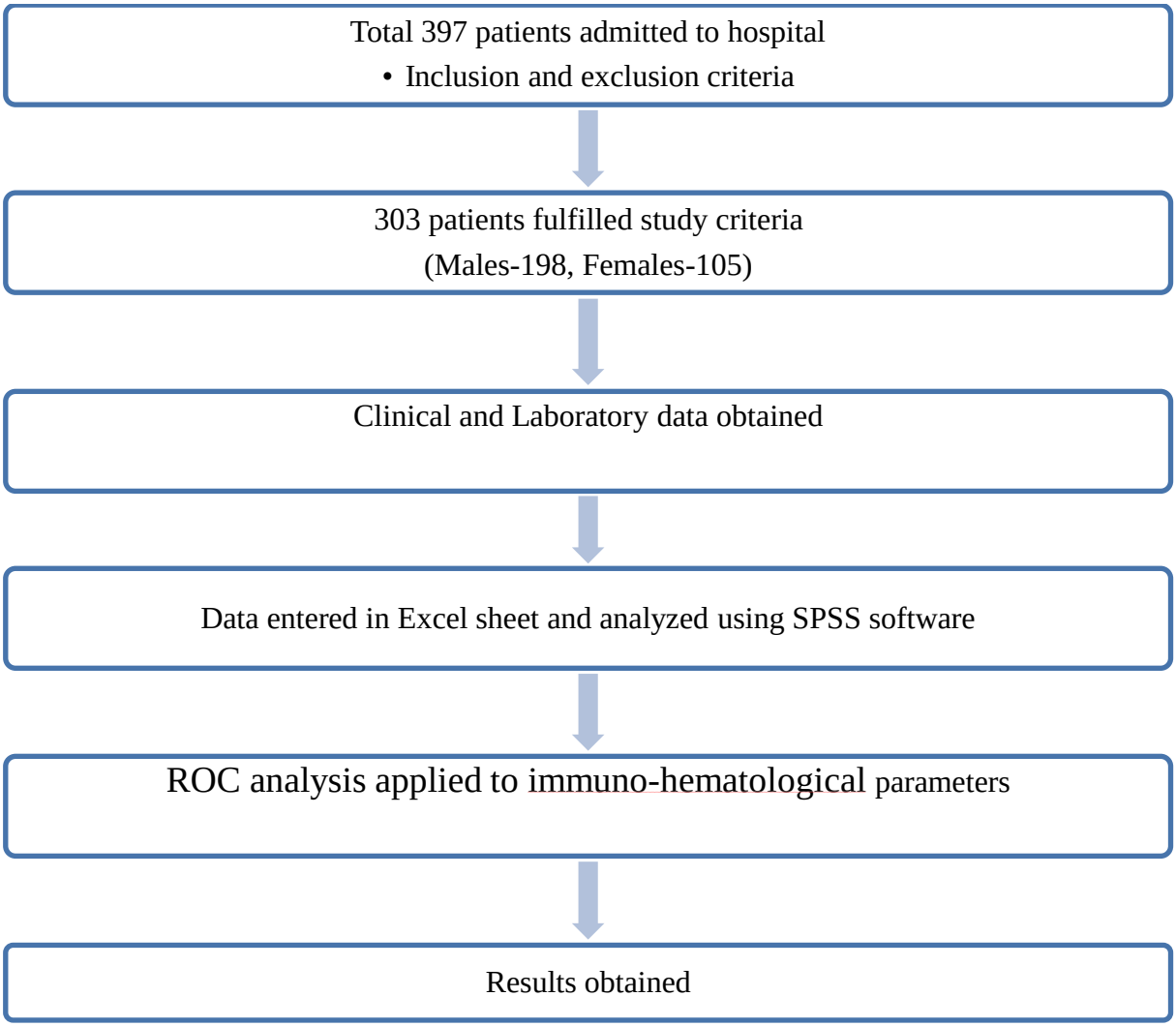
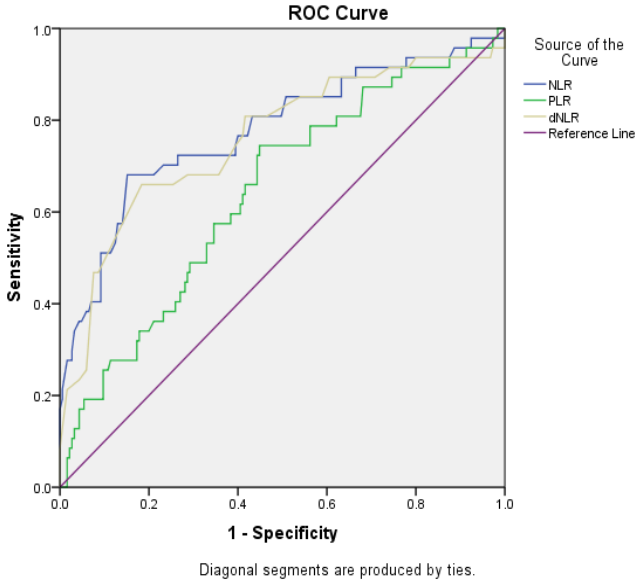


Figure 1: Study protocol.



AUC	
Test result variable(s)	Area
NLR	0.777
PLR	0.642
dNLR	0.799

Figure 2: Receiver operator characteristic curve analysis of NLR, dNLR and PLR.

DISCUSSION

The first defense against infection in the host was provided by leukocytes, in which neutrophil predominated.[6] Several laboratory abnormalities were found in COVID-19 patients of which, neutrophilia and lymphopenia were associated with disease severity and outcomes.[7] This study analyzed the effectiveness of immune-haematological marker in predicting the disease severity and compared it with other inflammatory markers and radiological severity in prognosticating outcome.

The inflammatory parameters in present study showed a significant difference between the patients recovered in comparison to outcome as death. In present study, we found a significant higher mean of the NLR and dNLR among the patients with worst outcome compared to the patients who survived and discharged. On correlation, the dNLR found to have a significant strong strength of positive association with the CT severity score compared to the NLR, PLR and ESR. The dNLR appeared to be superior to the NLR in association with the CT severity score and outcome among the patients with COVID-19. In concordance to present study, Yang et al concluded that the dynamic parameters, that was, lymphocyte count, neutrophil count, lymphocyte monocyte ratio (LMR) and NLR significantly differed and helped discriminate between non-severe and severe groups.[8] In a retrospective study by Ramesh et al they evaluated 154 severe COVID-19 patients (diabetic subset-57) and derived cut-offs for TLC-8950 cells/cumm, ANC-7679 cells/cumm, NLR-5.14 and dNLR-3.44 which were significantly associated with mortality.[9]

CONCLUSION

In COVID-19, immuno-haematological markers like NLR, dNLR, PLR were found to be a simple and cost-effective tool to prognosticate the clinical outcome among hospitalized patients and were in concordance with the other inflammatory markers. Hence, NLR, dNLR and PLR serve as cost effective indicators in risk stratification and better management which improves outcome even in the presence of normal leukocyte count.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Martin A, Markhvida M, Hallegatte S, Walsh B. Socio-economic impacts of covid-19 on household consumption and poverty. Econ Disaster Clim Change. 2020;4:1-27.
2. Nicola M, Alsafi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, et al. The socio-economic implications of the coronavirus pandemic (COVID-19): a review. Int J Surg. 2020;78:185-93.
3. Liao D, Zhou F, Luo L, Xu M, Wang H, Xia J, et al. Haematological characteristics and risk factors in the classification and prognosis evaluation of COVID-19: a retrospective COHORT study. Lancet Haematol. 2020;7(9):671-8.
4. Seyit M, Avci E, Nar R, Senol H, Yilmaz A, Ozen M, et al. Neutrophil to lymphocyte ratio, lymphocyte to monocyte ratio and platelet to lymphocyte ratio to predict the severity of COVID-19. Am J Emerg Med. 2021;40:110-4.
5. Wang C, Zhang H, Cao X, Deng R, Ye Y, Fu Z, et al. Red cell distribution width (RDW): a prognostic indicator of severe COVID-19. Ann Transl Med. 2020;8(19).
6. Li Y, Wang W, Yang F, Xu Y, Feng C, Zhao Y. The regulatory roles of neutrophils in adaptive immunity. Cell Commun Signal. 2019;17(1):147.
7. Henry B, Cheruiyot I, Vikse J, Mutua V, Kipkorir V, Benoit J, et al. Lymphopenia and neutrophilia at admission predicts severity and mortality in patients with COVID-19: a meta-analysis. Acta Biomed. 2020;91(3):2020008.
8. Yang H, Xu Y, Li Z, Yan L, Wang J, Liao P. The clinical implication of dynamic hematological parameters in COVID-19: a retrospective study in Chongqing. Int J Gen Med. 2021;14:4073-80.
9. Ramesh J, Reddy SLS, Rajesh M, Varghese J. Evaluation of simple and cost-effective immuno-haematological markers to predict outcome in hospitalized severe COVID-19 patients, with a focus on diabetes mellitus: a retrospective study in Andhra Pradesh, India. Diabetes Metab Syndr. 2021;15(3):739-45.

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