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ORIGINAL RESEARCH

Critical evaluation of Haematological and Biomarker variation in COVID -19 patients – A Prospective study in Level 2 Tertiary care hospital (Lucknow West)

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Abstract

Background: In India, the first case of COVID-19 was reported on January 30, 2020. The case reporting is based on the testing of individuals by Real-time Reverse Transcription-Polymerase Chain Reaction (RT-qPCR). The present study was conducted to evaluatedifferent parameters,Haematological and Biomarker variations in patients with SARS-CoV2 Infection to assess the prognostic significance.

Material & Methods: The present prospective study was conducted among 70 patients who were diagnosed with COVID-19 infection. Relavant physical examination and clinical data of the patient and routine blood investigations including, CBC, serum biochemistry,coagulation function and measurement of inflammatory markers were performed. The results were analyzed by using a SPSS Statistics software version 25.0.

Results: In the present study total patients were 70 out of which 58.6% were males and 41.4% were females. Maximum subjects belong to age group 61-80 yrs (47.1%). Mean haemoglobin was 12.89g/l, mean platelet was $9.96\times10^{3/}$µl. Mean neutrophil were 88.21%, mean lymphocyte were 8.84%, mean eosinophil were 1.47%, mean monocyte was 1.59%, mean TLC was 12007.14/µl. Mean random blood sugar was 148.09mg/dl. Mean D-dimer was 0.56. Mean CRP levels were 65.5mg/l. Mean LDH was 516.03 IU/L, mean IL-6 was 282.6pg/ml, and mean procalcitonin was 0.8ng/ml. Mean SGOT was 62.36u/l, mean ALP was 171.87IU/L, mean urea levels were 57.10mg/dl and mean INR was 1.22.Outcome mortality was present in total 14 subjects (5 were male and 9 were female) out of all 70 subjects.

Conclusion: The present study concluded that Mean values of neutrophil, eosinophil, TLC, random blood sugar, IL6, SGOT, ALP, urea levels and INR were increased in patients with SARS-CoV2 Infection.

Keywords: SARS-CoV2, SGOT, RT-PCR, COVID-19.

Introduction

The variable incubation period of COVID-19 infections of up to 14 days and an unknown number of asymptomatic carriers capable of transmitting the infection are big challenges for COVID-19 control and mitigation efforts. Mass testing is important for a wide-range of

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further COVID-19 control strategies including checking for community transmission.[1]Reverse Transcription Polymerase Chain Reaction (RT-PCR) and Chest Computed Tomography (CT) scan are the main tools for diagnosis of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection,[2]and some CT manifestations may be associated with the progression and prognosis of COVID-19.[3] However, clinical application of CT is restricted by many factors, such as limited medical resources and high examination costs. Thus, convenient and cost-effective indicators are urgently required to simplify the diagnostic process and evaluate the disease severity.[4] Hematological markers, including neutrophils, lymphocytes, monocytes, platelets, neutrophil-to-lymphocyte ratio (NLR), monocyte-to-lymphocyte ratio (MLR), and platelet-to-lymphocyte ratio (PLR), have been proposed as indicators to assist in the diagnosis, early warning, and risk stratification of infectious diseases.[5] These parameters are easily measured at low cost using modern haematological analyzers and play role in determination of prognosis.[6]Therefore, the present study was conducted to monitor different parameters of patients with SARS-CoV2 Infection and to see the prognosis.

Material & Methods

The present prospective study was conducted at Career Institute of Medical Sciences and Hospital , Lucknow which comes under dedicated L-2 COVID hospital based on clinical severity as per guidelines approved by ICMR. A Totalof 70 patients were admitted in our hospital , [7] who were diagnosed with COVID-19 infection through RT-PCR by using nasal and throat samples in all patients suspected of SARS-CoV-2 infection. Most of the patients were admitted with fever and respiratory symptomsand were diagnosed with pneumonia on Computed Tomography Scan. All the general information, clinical data of the patient was extracted through a medical record system available at the hospital. Routine blood investigations including hematological parameters, serum biochemistry,coagulation functiontest and measurement of inflammatory markers were performed within 24 hours of admission. Pulse oxygen saturation data were collected immediately upon admission. The results were analyzed by using a SPSS Statistics software version 25.0. The data with a normal distribution were expressed as mean ± standard deviation (SD).

Results

In the present study total patients were 70 out of which 58.6% were males and 41.4% were females.(Chart 1)Maximum subjects belong to age group 61-80 yrs(47.1%).(Graph 1) Mean haemoglobin was 12.89g/l, mean platelet was 9.96×10^{9}/L. Mean neutrophil were 88.21%, mean lymphocyte were 8.84%, mean eosinophil were 1.47%, mean monocyte was 1.59%, mean TLC was 12007.14/µl. Mean random blood sugar was 148.09mg/dl. Mean D-dimer was 0.56. Mean CRP levels were 65.5mg/l. mean LDH was 516.03 IU/L, mean IL6 was 282.6pg/ml, mean ferritin was 49.8µg/l and mean procalcitonin was 0.8ng/ml. (Graph 2) Mean SGOT was 62.36u/l, mean SGOT was 65.56,mean ALP was 171.87IU/L, mean urea levels were 57.10mg/dl and mean INR was 1.22. (Graph 3). Table 4 shows distribution of study subjects according to HRCT chest CT score grades at time of C0VID 19 presentation results among all 70 subjects 14 shows mild grade involvement , 31 moderate and 25 subjects had severe grade of involvement of lung according to CT score.(Graph 4) Table 5 shows distribution of genderwise study subjects according to mortality ,results revealed that outcome mortality was present in total 14 subjects (5 were male and 9 were female) out of all 70 subjects.(Chart 2)

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Table 1: Demographic characteristics of patients

	Frequency	Percent
Age Group (Years)		
21-40	11	15.7
41-60	26	37.1
61-80	33	47.1
Gender		
Female	29	41.4
Male	41	58.6

Graph 1: Age wise distribution of study subjects

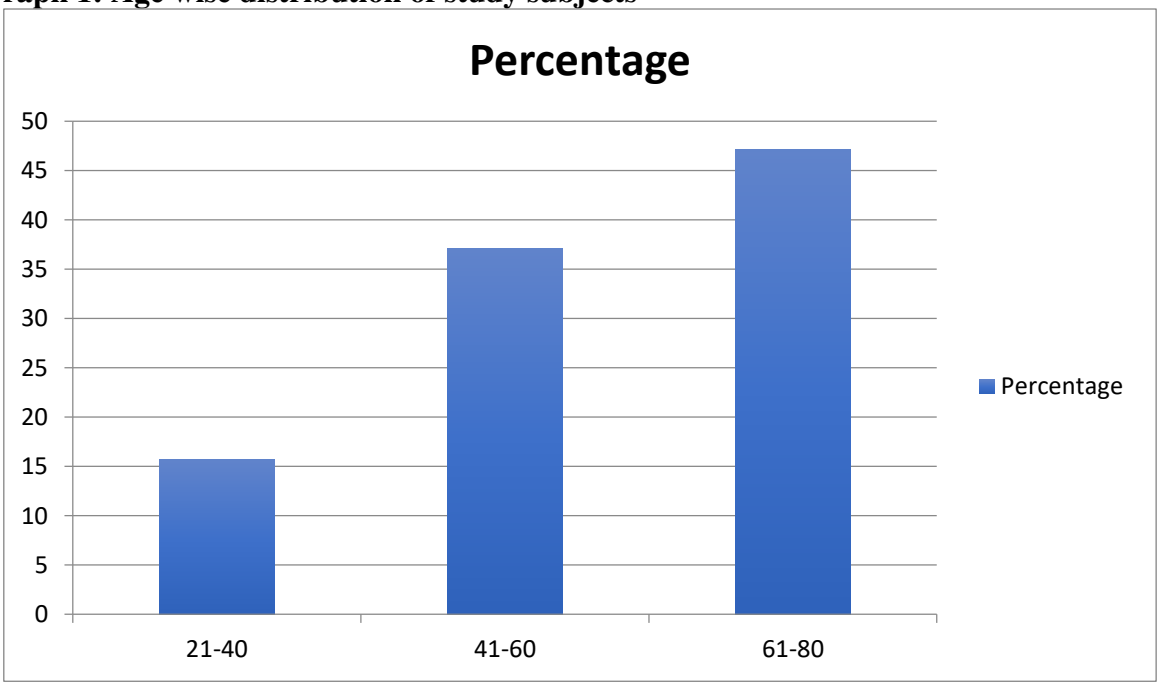
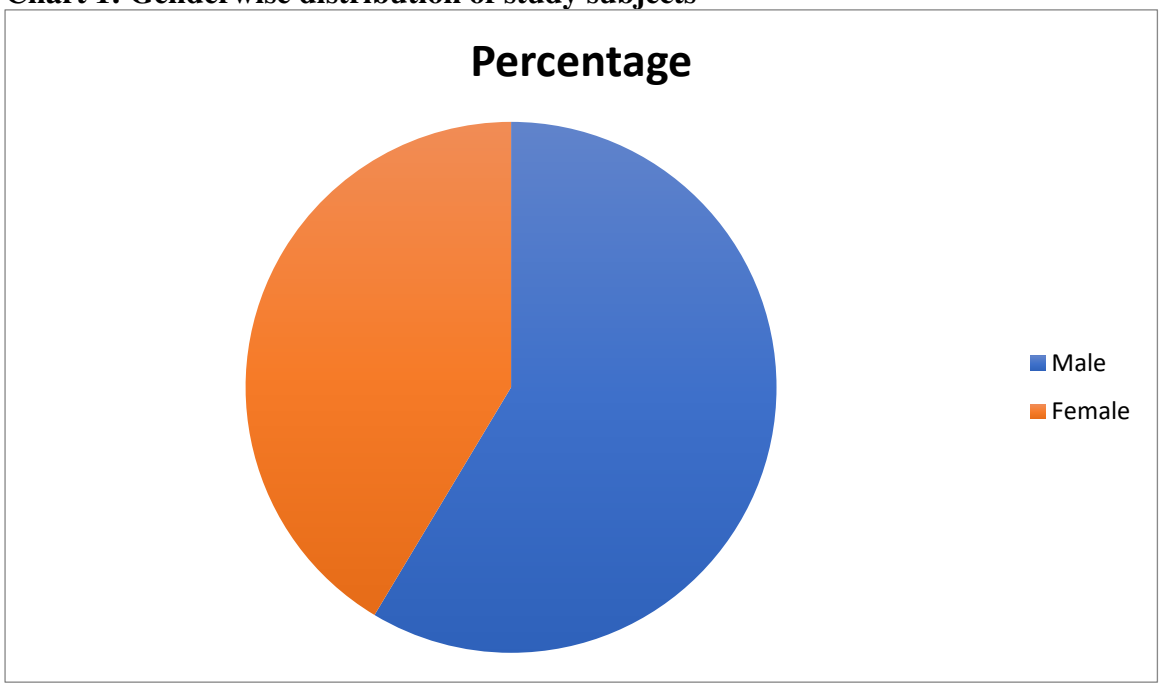


Chart 1: Genderwise distribution of study subjects



ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Table 2: Mean Haematological parameters among subjects

	Minimum	Maximum	Mean	Std. Deviation
Haemoglobin	8.70	17.50	12.89	1.88
Platelet	0.53	540.00	9.96	64.28
Neutrophil	55.00	97.00	88.21	5.89
Lymphocyte	2.00	38.00	8.84	5.15
Eosinophil	1.00	5.00	1.47	0.72
Monocyte	0.00	3.00	1.59	0.69
TLC	2500.00	22500.00	12007.14	4398.46
Random blood sugar	80.00	250.00	148.09	41.65
D-Dimer	0.20	0.90	0.56	0.19

Table3: Mean Inflammatory parameters among subjects

	Minimum	Maximum	Mean	Std. Deviation
CRP	10.2	106.0	65.5	33.4
LDH	45.6	1507.0	516.0	235.6
IL6	1.9	680.0	282.6	194.4
Ferritin	49.8	692.0	321.1	124.7
Procalcitonin	0.0	2.4	0.8	0.7

Graph 2: Mean Inflammatory parameters among subjects

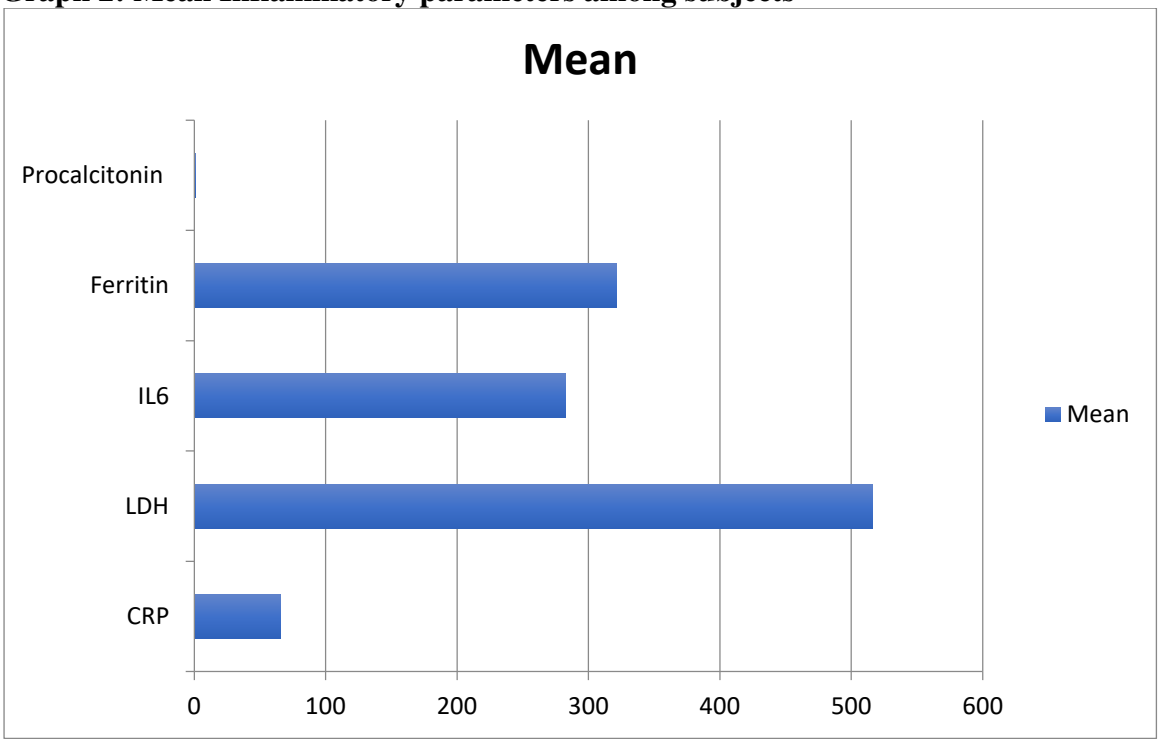


Table 4: Mean biochemical parameters among subjects

	Minimum	Maximum	Mean	Std. Deviation
SGOT	24.0	212.0	62.4	30.0
SGPT	22.00	177.00	65.56	28.92
ALP	48.0	460.0	171.9	69.2
UREA	15.0	139.0	57.1	24.5
INR	0.8	1.8	1.2	0.2

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Graph 3: Mean biochemical parameters among subjects

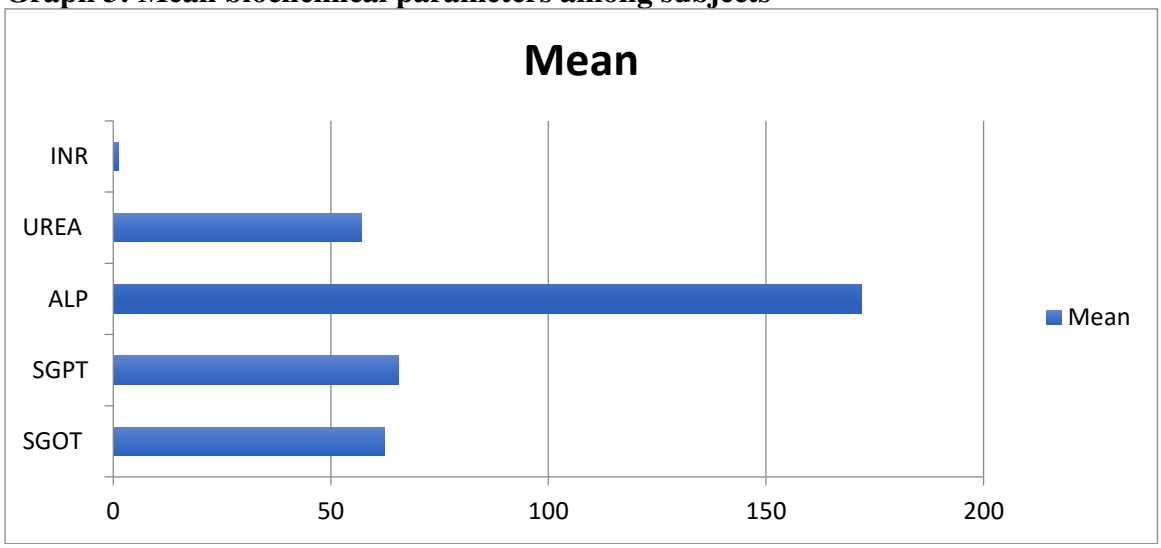
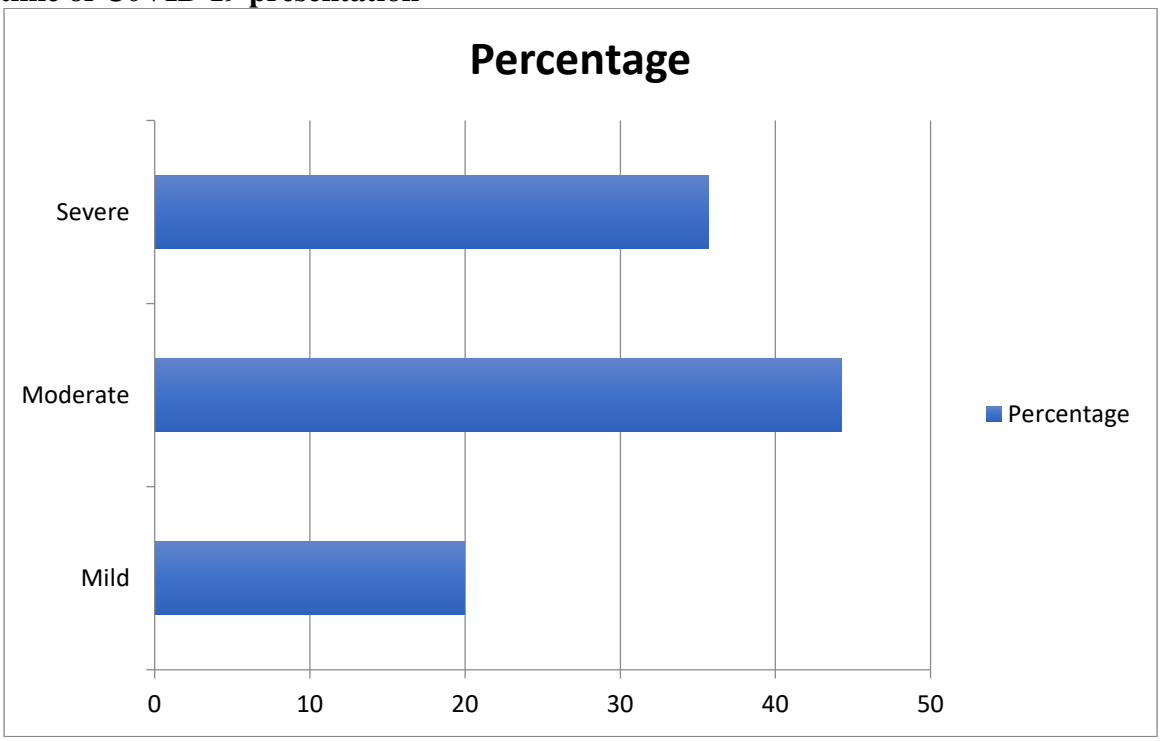


Table 4: Distribution of study subjects according to HRCT chest CT score grades at time of C0VID 19 presentation

CT Grade	Frequency	Percentage
Mild	14	20
Moderate	31	44.28
Severe	25	35.71
Total	70	100.0

Table 4 and graph shows distribution of study subjects according to HRCT chest CT score grades at time of C0VID 19 presentation, 14 (20%) patients were of mild grade, 31 (44.28) were of moderate grade, 25 (35.71%) were of severe grade.

Graph 4: Distribution of study subjects according to HRCT chest CT score grades at time of C0VID 19 presentation



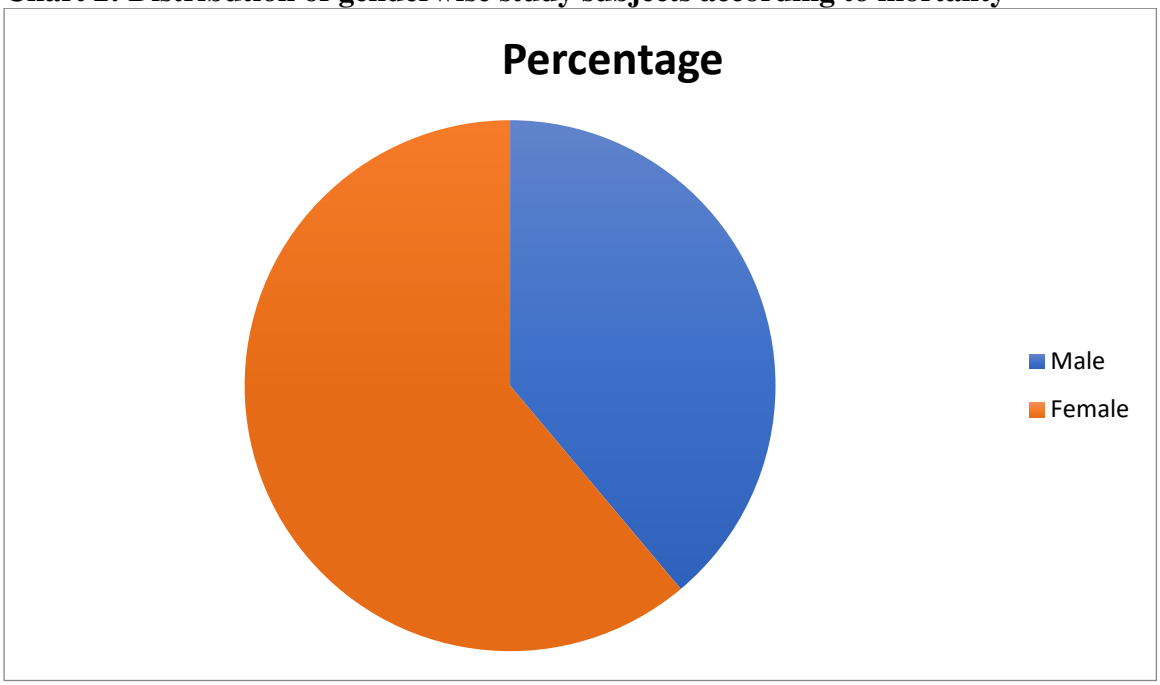
ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Table 5: Distribution of genderwise study subjects according to mortality

Gender	Frequency	Percentage
Male	5	35.7
Female	9	64.28
Total	14	100

Table 5 and chart 2 reports mortality data of 70 study patients, 5 (35.7%) patients were male and 9 (64.2%) were female who could not survive.

Chart 2: Distribution of genderwise study subjects according to mortality



Discussion

The 2019nCoV resulted into ongoing outbreak of lower respiratory tract disease called novel coronavirus pneumonia (NCP) by the Chinese government initially. The disease name was subsequently recommended as COVID-19 by the World Health Organization. Meanwhile, 2019-nCoV was renamed SARS-CoV-2 by the International Committee on Taxonomy of Viruses.[7] Laboratories have begun to demonstrate that SARS-CoV-2 can be detected in RT-qPCR performed on pooled samples, despite potential dilution.[8]The complete blood count (CBC) is a quick, easy, and inexpensive measurement in clinical practice, providing rich information about hematologic contents, including WBCs, neutrophils, lymphocytes, monocytes, platelets, NLR, MLR, and PLR. In recent years, hematologic markers have drawn attention as potential indicators to assist in the diagnosis, early warning, and risk stratification in many infectious diseases, such as sepsis, bacteremia, and urinary tract infection, as well as various non-infectious diseases, including hepatic cirrhosis, coronary artery disease, and solid tumors.[5,9-11]Therefore, the present study was conducted to monitor different parameters of patients with SARS-CoV2 Infectionand to see the prognosis.

In the present study total patients were 70 in which 58.6% were males and 41.4% were females. Maximum subjects belong to age group 61-80 years (47.1%). Another comparable studies from Singapore by Young et al and Fan et al included 18 (critically ill) and 69 (not critically ill) confirmed cases of COVID-19 respectively, with a median age of 47 and 41 years. One study showed a male predominance (55.2%) while the other had equal sex distribution.[12,13]

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

In the present study, mean haemoglobin was 12.89g/l, mean platelet was $9.96\times10^{9/}$L. Mean neutrophil were 88.21%, mean lymphocyte were 8.84%, mean eosinophil were 1.47%, mean monocyte was 1.59%, mean TLC was 12007.14/µl. Mean random blood sugar was 148.09mg/dl. Mean D-dimer was 0.56. Mean CRP levels were 65.5mg/l. mean LDH was 516.03 IU/L, mean IL6 was 282.6pg/ml, mean ferritin was 321.11µg/l and mean procalcitonin was 0.8ng/ml.Mean SGOT was 62.36u/l, mean ALP was 171.87IU/L, mean urea levels were 57.10mg/dl and mean INR was 1.22. Comparing present study with like studies, Parashar B et al found that Lymphocyte counts were reduced in the routine blood-work for all patients, but significantly lower in L2-type patients. Elevation of D-Dimer with near normal PT and APTT were detected in coagulation function tests, and more significant changes were observed in L2-type patients compared to L1-type patients. Serum ferritin levels were sensitive to SARS-CoV (severe acute respiratory syndrome coronavirus-2) infection and found to rise in L2-type patients more than L1-type patients. Inflammatory markers, CRP and Interleukin-6 (IL-6) were significantly increased in all patients, but higher in L2-type patients compared to L1-type patients.[14]Patel KV et al carried out a study on hematological parameters in patients with COVID-19 infection at a tertiary care centre. Among the 50 patients, there were 35 (70%) males and 15 (30%) females with an age range from 6 months to 82 years with twenty-five patients above 50 years. There was lymphopenia in 18 patients (36%), leukopenia in 2 patients (4%) and thrombocytopenia in 8 (16%) patients.[15]

Recent reports have shown that lymphocyte counts are normal in COVID-19 patients with mild disease. In contrast, 20–96.1% of severe diseases have lymphopenia.[16,17]In another comparable study,Yang H et al analyzed the clinical characteristics of patients with coronavirus disease 19 (COVID-19) in Chongqing, and identify the potential hematological markers for reference and found that the patients in the severe group exhibited significantly lower lymphocyte ($P< 0.05$) but higher neutrophil to lymphocyte ratio (NLR) ($P< 0.05$) than the patients in the non-severe group. The highest area under the ROC curve (AUC) was lymphocyte (0.74). The patients in the severe group had a lower level of lymphocyte during hospitalization ($P< 0.01$) and lymphocyte-monocyte ratio (LMR) in the progressive and convalescent phases ($P< 0.05$) than the patients in the non-severe group. However, the level of neutrophil of the patients in the severe group was higher in the progressive phase ($P< 0.05$), and so was NLR in the acute, progressive, and convalescent-phase ($P< 0.05$).[18]Peng J et al determine the diagnostic value of hematologic markers for coronavirus disease 2019 (COVID-19) and explore their relationship with disease severity. Compared with healthy subjects, COVID-19 patients had lower white blood cell (WBC), lymphocyte, platelet, and hemoglobin levels; higher percentages of neutrophils and monocytes; lower percentages of lymphocytes and higher neutrophil-to-lymphocyte ratio (NLR), monocyte-to-lymphocyte ratio (MLR), and platelet-to-lymphocyte ratio (PLR) values ($P < .05$). COVID-19 patients had higher WBC and neutrophil levels and lower percentages of lymphocytes compared to IP ($P < .05$). ROC curve analysis revealed that MLR had a high diagnostic value in differentiating COVID-19 patients from healthy subjects, but not from IP patients. NLR showed significant positive correlations with PSI, CURB-65, and MuLBSTA. Lymphocyte count was lower in the ARDS group and yielded a higher diagnostic value than the other variables.[4]

In the present study distribution of study subjects according to HRCT chest CT score grades at time of C0VID 19 presentation, 14 (20%) patients were of mild grade, 31 (44.28) were of moderate grade, 25 (35.71%) were of severe grade. The mortality data of present study among 70 study patients revealed that 5 (35.7%) patients were male (total 41 were male patients out of 70) and 9 (64.28%) were female (total 29 were male patients out of 70) who could not survive.In a comparable study carried out by Francone M et al, CT score was

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positively correlated with age, inflammatory biomarkers, severity of clinical categories, and disease phases and also demonstrated that CT parenchymal assessment may more accurately reflect short-term outcome, providing a direct visualization of anatomic injury compared with non-specific inflammatory biomarkers.[19]In another study, Wu C et al compared CT scoring with most important independent risk factors associated with ARDS and fatal outcome, which were reported to be age, dyspnea at admission, and the presence of pre-existing comorbidities like coronary arteries and cerebrovascular diseases.[20]Another comparable study by Tabatabaei SMH et al, extensive lung involvement on initial CT, ICU admission, long duration of hospitalization, presence of underlying medical conditions, high initial WBC count, and development of leukocytosis during the course of disease are associated with more prevalence of chronic lung sequela of COVID-19.[2]

Conclusion

The present study concluded that Mean values of neutrophil, eosinophil, TLC, random blood sugar, IL6, SGOT, ALP, urea levels and INR were increased in patients with SARS-CoV2 Infection.

References

1. Sharfstein JM, Becker SJ, Mello MM. Diagnostic testing for the novel coronavirus. JAMA. 2020. doi: 10.1001/ jama.2020.3864.
2. Tabatabaei SMH, Rajebi H, Moghaddas F, Ghasemiadl M, Talari H. Chest CT in COVID-19 pneumonia: what are the findings in mid-term follow-up? EmergRadiol. 2020 Dec;27(6):711-719.
3. Shi H, Han X, Jiang N, et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *Lancet Infect Dis*. 2020; **20**(4): 425-434
4. Peng J, Qi D, Yuan G, Deng X, Mei Y, Feng L, Wang D. Diagnostic value of peripheral hematologic markers for coronavirus disease 2019 (COVID-19): A multicenter, cross-sectional study. Journal of clinical laboratory analysis. 2020 Oct;34(10):e23475.
5. Russell CD, Parajuli A, Gale HJ, et al. The utility of peripheral blood leucocyte ratios as biomarkers in infectious diseases: a systematic review and meta-analysis. *J Infect*. 2019; **78**: 339- 348.
6. Lin S, Mao W, Zou Q, Lu S, Zheng S. Associations between hematological parameters and disease severity in patients with SARS-CoV-2 infection. Journal of clinical laboratory analysis. 2021 Jan;35(1):e23604.
7. Yuen KS, Ye ZW, Fung SY, Chan CP, Jin DY. SARS-CoV-2 and COVID-19: The most important research questions. *Cell Biosci*. 2020;10:40. Published 2020 Mar 16. doi:10.1186/s13578-020-00404-4
8. Garg J, Singh V, Pandey P, Verma A, Sen M, Das A, Agarwal J. Evaluation of sample pooling for diagnosis of COVID-19 by real time-PCR: A resource-saving combat strategy. Journal of medical virology. 2021 Mar;93(3):1526-31.
9. Alempijevic TM, StojkovicLalosevic M, Dumic I, et al. Diagnostic accuracy of platelet count and platelet indices in noninvasive assessment of fibrosis in nonalcoholic fatty liver disease patients. *Can J Gastroenterol Hepatol*. 2017; **2017**:e6070135.
10. Serrano CV, De Mattos FR, Pitta FG, et al. Association between neutrophil-lymphocyte and platelet-lymphocyte ratios and coronary artery calcification score among asymptomatic patients: data from a cross-sectional study. *Mediators Inflamm*. 2019; **2019**:e6513847.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

11. Bilen MA, Martini DJ, Liu Y, et al. The prognostic and predictive impact of inflammatory biomarkers in patients who have advanced-stage cancer treated with immunotherapy. *Cancer*. 2019; **125**(1): 127- 134.
12. Young BE, Ong SWX, Kalimuddin S, et al. Epidemiologic Features and Clinical Course of Patients Infected With SARS-CoV-2 in Singapore. JAMA 2020;323(15):1488-1494. Crossref
13. Fan BE, Chong VCL, Chan SSW, et al. Hematologic parameters in patients with COVID-19 infection. Am J Hematol. 2020;95(6): E131-E153.
14. Parashar, B., Pathak, M., & Ahmad, A. (2021). Laboratory analysis of patients with SARSCoV-2 Infection in a semi-urban COVID-19 center of Lucknow, India. International Journal of Health Sciences, 5(S2), 431–443. https://doi.org/10.53730/ijhs.v5nS2.5865.
15. Patel KV, Parmar AR, Sharma BS, Thacker M, Patel N, Patel B. A study of hematological parameters in patients with COVID-19 infection at a tertiary care centre. J Pathol Nep 2021;11:1852- 8.DOI: 10.3126/jpn.v11i1.31401
16. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. 2020;382(18):1708–1720. doi:10.1056/NEJMoa2002032.
17. Ding X, Yu Y, Lu B, et al. Dynamic profile and clinical implications of hematological parameters in hospitalized patients with coronavirus disease 2019. *Clin Chem Lab Med*. 2020;58(8):1365–1371. doi:10.1515/cclm-2020-0411
18. 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, China. *Int J Gen Med*. 2021;14:4073-4080 https://doi.org/10.2147/IJGM.S321292
19. Francone M, Iafrate F, Masci GM, Coco S, Cilia F, Manganaro L, Panebianco V, Andreoli C, Colaiacomo MC, Zingaropoli MA, Ciardi MR, Mastroianni CM, Pugliese F, Alessandri F, Turriziani O, Ricci P, Catalano C. Chest CT score in COVID-19 patients: correlation with disease severity and short-term prognosis. EurRadiol. 2020 Dec;30(12):6808-6817.
20. Wu C, Chen X, Cai Y. Xia J'an, Zhou X, Xu S, et al. Risk Factors Associated With Acute Respiratory Distress Syndrome and Death in Patients With Coronavirus Disease. JAMA Intern Med. 2020 Jul 1;180(7):1031.