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Association of Lung CT-scans and Laboratory Findings with Disease Outcomes in COVID19- Patients

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ABSTRACT

Introduction: The COVID-19 pandemic has underscored the necessity of investigating the relationship between radiological and laboratory findings with disease outcome in COVID-19 patients. This study aimed to explore the association between CT-scan finding and laboratory results with disease outcome, including recovery without complications, ICU admission, or mortality.

Methods: This retrospective cross-sectional study analyzed medical records and laboratory data from COVID-19 patients at Ghaem Hospital, Mashhad, Iran, from September 2020 to September 2022. All demographic, laboratory findings, as well as CT-scan data such as ground-glass opacity, consolidation, pleural effusion, cardiomegaly, mediastinal lymphadenopathy, and pulmonary involvement score at admission were collected. Patients were categorized based on their death/alive status and compared for all study variables.

Results: Significance differences were observed for CT-score values between deceased patients and those who recovered (P<0.001), indicating a more severe lung changes in patients who died due to COVID-19. Additionally ICU-admitted patients had higher likelihood of underlying comorbidities and elevated CT-score levels. Laboratory markers such as ESR, Ferritin, LDH, Neutrophil count, and RDW were significantly higher in patients requiring ICU admission (P<0.05). Deceased patients were more likely to have underlying diseases, ground glass opacity, cardiomegaly, and higher CT-scores. Laboratory markers such as ESR, CRP, Ferritin, LDH, and others were also significantly higher in expired patients.

Conclusion: There was a strong association between laboratory and CT-scan findings with disease mortality in COVID-19 patients. The combination of laboratory markers and CT-scan findings can serve as robust predictors of disease outcomes. Further studies are needed to validate these findings in larger cohorts.

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Introduction

The outbreak of COVID-19, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2, COVID-19), has become a global pandemic, affecting millions of people worldwide. While many cases present as mild to moderate infections, a significant proportion can progress to life-threatening complications such as severe pneumonia and acute respiratory

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distress syndrome within the initial weeks of the onset of symptoms. Elderly individuals and those with underlying comorbidities, including diabetes, hypertension, ischemic heart disease, and obstructive lung diseases, are particularly susceptible to severe forms of the disease, which can rapidly lead to multi-organ damage and intensive care unit (ICU) admission (1).

The high mortality rate associated with COVID-19 is a major concern, with approximately 15.7% to 26% of hospitalized patients developing severe forms of covid-19 (2, 3). Early detection and prompt treatment are crucial to preventing disease progression and improving patient outcomes (3). Computed tomography (CT) have emerged as a valuable diagnostic tool for identifying clinically suspicious patients with negative Polymerase Chain Reaction (PCR) results (4, 5). The most common CT findings in COVID-19 patients include peripheral ground-glass opacity, consolidation, and pleural effusion (6).

Moreover, laboratory examinations have also been shown to play a critical role in predicting disease severity. Studies have identified various biomarkers, including white blood cell (WBC) count, C-reactive protein (CRP), ferritin, Liver function tests (LFT), Lactate-dehydrogenase (LDH), erythrocyte sedimentation rate (ESR), and other inflammatory that are associated with disease severity (7). Ferritin and CRP are acute-phase reactant proteins that increase during inflammatory processes. Notably, WBC count and absolute neutrophil count often increase in COVID-19 patients, while severe conditions are characterized by lower lymphocyte levels (8).

Despite the existing literature on this topic, there remain a need for a better understanding of radiological and laboratory features as predictors of severe conditions. This knowledge gap hinders clinicians from providing optimal treatments and reducing the risk of ICU admission and mortality rates. Therefore, this study aimed to investigate the association of CT scan results and laboratory parameters with disease severity, ICU admission, and mortality rate in COVID-19 patients. By identifying key predictors of poor outcomes, this study may inform clinical decision-making and improve patient care strategies.

Materials and Method

Study design and Patients selection

This retrospective cohort study recruited all patients admitted to the COVID-19 ward of Ghaem Hospital, Mashhad, Iran, between September 2020 and September 2022, who met the following inclusion criteria: a) confirmed COVID-19 diagnosis within five days of admission, b) underwent CT scan and laboratory tests during hospitalization, and c) had complete records in the hospital information system (HIS). Patients without complete laboratory or CT data were excluded from further analyses. COVID-19 diagnosis was confirmed based on established diagnostic protocols incorporating RT-PCR, laboratory analyses, and radiological outcomes. The study protocol fulfilled the declaration of Helsinki and was approved by the research ethics committee of Mashhad University of Medical Sciences with a code of IR.MUMS.MEDICAL.REC.1400.236.

Data collection

Patients' information was extracted from archived hospital records and HIS through comprehensive checklists, including demographic and clinical data such as age, gender, comorbidities (autoimmune diseases, hypertension, diabetes, ischemic heart disease, heart failure, chronic obstructive pulmonary disease, and malignancy), medication history, primary laboratory results, and CT-scan findings (ground-glass opacity, consolidation, pleural effusion, cardiomegaly, mediastinal lymphadenopathy, and lung CT-score). Patients were categorized according to their need for intensive care unit (ICU) admission (ICU admitted/not admitted) and their disease outcome (recovery/mortality). The correlation between laboratory results, CT score, ICU admission, and mortality rate was later analyzed.

Laboratory tests

Peripheral venous blood was collected for laboratory tests using standard techniques. Laboratory tests were measured using the following methods: Complete blood count (CBC) via autoanalyzer Technicon H1 (Bayer Medical Systems, NY, USA), Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST), via autoanalyzer Technicon RA-1000 (Bayer Medical Systems, NY, USA), ESR by Westergrin method, ferritin through enzyme-linked immunosorbent assay (ELISA) (Pishtaz Company, Iran), urea, creatinine, and C-reactive protein (CRP) levels by universal standard protocols, and LDH by Mindray auto-analyzer (BS 800).

Data analysis

Data were analyzed using SPSS software version 22. Categorical variables were reported as frequency (%), and continuous variables as Mean ± SD and/or Median (interquartile range). The Chi-square test was used to assess differences between categorical variables. Normality of continuous variables was determined using the

Kolmogorov-Smirnov test and corresponding histograms. Independent sample t-test was used to compare the normally distributed variables, while non-normally distributed variables were compared using the Mann-Whitney U test.

Results

Demographics and clinical characteristics

A total of 305 COVID-19 patients, comprising 56.4% males and 43.6% females with a mean age of 65.62 ± 18.05 years were enrolled in this study. The demographic and clinical characteristics of all participants are summarized in Table 1. Diabetes was the most common underlying disorder, affecting 14.4% of patients. Around 31.1% of patients required ICU admission, and 36.1% expired during their hospital stay.

Laboratory findings

Data regarding the serum levels laboratory measurements either at the admission onset or before discharge are presented in table 2. Serum levels of ALT (p=0.030), total bilirubin (p<0.001), hemoglobin (p<0.001), and hematocrit (p<0.001) were significantly decreased from admission to discharge. However, mean MCV (p<0.001) and RDW (p<0.001) were significantly elevated during the disease period.

Radiological findings

Lung CT-scan findings of COVID-19-affected patients are listed in Table 3. These results revealed that consolidation was the most common radiological finding, occurring in 86.3% of patients, followed by ground-glass opacity in 78.9%.

Table 1. Demographics and clinical characteristics of participants

Demographic and Clinical findings		Frequency (percentage)/ Mean ± SD
Gender	Male	172 (56.4)
	Female	133 (43.6)
Age		65.62 ± 18.05
Underlying diseases	Normal	117(38.4)
	Diabetes	44(14.4)
	Hypertension	31(10.2)
	Ischemic heart disease	22(7.2)
	COPD	14(4.6)
	More than one disease	77(25.2)
ICU Admission		95(31.1)
Mortality		109(36.1)

Table 2. Initial and discharge laboratory parameters in Patients with COVID-19

Variables	Timepoint		P-value*
	At admission Mean±SD/ Median (Q1-Q3)	At discharge Mean±SD/ Median (Q1-Q3)	
ESR	33.62 ±53.13	52.82 ± 48.28	0.670
CRP	69.70 (34-129)	38.0 (21-157)	0.512
Ferritin	419.0 (239.0-730.0)	306.0 (164.5-896.5)	0.776
LDH	597.5 (433.0-883.5)	560.5 (385.3-911.8)	0.596
Cr	1.30 (1-2)	1.20 (0.9-2.05)	0.090
BUN	58(37.3-98.5)	59.0 (34.0-113.3)	0.783
AST	41.0 (24.0-71.0)	41.0 (28.0-75.0)	0.527
ALT	29.0 (16.0-51.8)	32.0 (19.0-63.3)	0.030
ALP	219 (169.8-320.3)	226.0 (172.0-313.0)	0.312
Bill-TD	0.3 (0.2-0.5)	0.4 (0.2-0.7)	< 0.001
WBC	8.90 (5.60-12.6)	8.1 (5.8-12.1)	0.463
Lymph	13.7 (8.7-21.60)	14.65 (8.1-22.2)	0.900
Neut	80.1 (69.3-85.8)	77.5 (67.2-86.4)	0.338
Hb	12.2 (10.0-13.9)	11.2 (9.4-12.9)	< 0.001
Hct	36.7 (31.7-13.9)	34.8 (30.1-39.4)	< 0.001
MCV	87.2 (83.8-91.1)	88.1 (83.9-92.0)	< 0.001
RDW	14.7 (13.2-16.52)	15.1 (13.8-17.0)	< 0.001
PLT	188.0 (131.5-262.0)	195.5 (118.0-273.3)	0.359

ESR: Erythrocyte sedimentation rate, CRP: C-reactive protein, LDH: Lactate Dehydrogenase, Cr: creatinine, BUN: Blood urea nitrogen, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, Bill-TD: Total Bilirubin WBC: white blood cell, Lymph: Lymphocyte count, Neut: Neutrophil count, Hb: Hemoglobin, Hct: Hematocrit, MCV: mean corpuscular volume RDW: red cell distribution, PLT: platelet count, * Mann–Whitney U test,

Table 3. CT-scan findings of patients with COVID-19

CT-Scan Findings	Frequency (Percentage)
Ground-glass opacity	232 (78.9)
Consolidation	253 (86.3)
Pleural effusion	73 (28.7)
Cardiomegaly	72 (27.7)

Association between Laboratory and Radiological Findings with ICU Admission Requirements

Patients were divided into two groups based on ICU admission requirements. Our analysis revealed that laboratory markers such as erythrocyte sedimentation rate (ESR) (P<0.001), Ferritin (P=0.041), lactate dehydrogenase (LDH) at admission (P=0.043), LDH at discharge (P<0.001), Neutrophil count (Neut) at admission (P=0.006), Neut at discharge (P<0.001), and red cell distribution (RDW) at discharge (P=0.012) were significantly higher in ICU-admitted patients (Table 4). In contrast, lymphocyte count (P=0.001), Hemoglobin (Hb) (P=0.041), and Hematocrit (Hct) (P=0.018), concentrations were lower in ICU-admitted patients. The likelihood of having additional underlying disorders (p=0.031) and higher CT-score levels (P=0.026) was also higher in ICU-admitted individuals. At the same time, no significant difference was found regarding CT-scan positive findings between the two groups.

Table 4. Association between laboratory markers and radiological features with risk of ICU admission

Variales	ICU Admission		P-value
	Admitted Mean± SD	Not-Admitted Mean± SD	
Age	63.32± 18.84	66.66± 17.62	0.134*
ESR at admission	55.67± 37.0	51.96± 31.96	0.378**
ESR at discharge	69.69± 52.41	44.42± 40.52	<0.001**
CRP at admission	103.21± 145.35	87.93± 76.1	0.739**
CRP at discharge	121.6± 104.2	76.78± 88.52	0.001**
Ferritin at admission	606.06± 383.07	500.67± 383.20	0.041**
Ferritin at discharge	749.20± 542.68	497.6± 507.00	0.001**
LDH at admission	809.71± 512.81	693.65± 536.61	0.043**
LDH at discharge	1088.80± 1121.9	781.94± 1199.68	<0.001**
Cr at admission	5.15± 1.46	1.94± 1.93	0.161**
Cr at discharge	2.12± 2.18	3.23± 1.79	0.677**
BUN at admission	75.4± 63.4	81.3± 68.12	0.244**
BUN at discharge	96.0± 78.1	79.4± 66.9	0.107**
AST at admission	105.23± 237.24	106.5± 385.27	0.993**
AST at discharge	114.88± 289.29	77.08± 160.97	0.208**
ALT at admission	91.54± 273.44	66.36± 189.00	0.787**
ALT at discharge	71.96± 142.44	65.60± 138.92	0.984**
ALP at admission	286.04± 197.19	328.77± 409.10	0.696**
ALP at discharge	300.88± 264.85	284.00± 212.02	0.124**
Bill_TD at admission	± 0.69 1.79	1.15± 6.62	0.288**
Bill_TD at discharge	1.05± 3.18	± 0.64 0.89	0.347**
WBC at admission	15.85± 36.69	10.27± 8.94	0.048**
WBC at discharge	10.75± 6.73	10.09± 9.39	0.091**
Lymph at admission	9.86± 14.03	16.43± 18.65	0.001**
Lymph at discharge	14.04± 12.62	19.25± 25.40	<0.001**
Neut at admission	78.78± 12.79	74.87± 13.77	0.006*
Neut at discharge	79.86± 12.79	73.94± 12.707	<0.001*
Hb at admission	12.09± 3.081	11.86± 3.023	0.523*
Hb at discharge	10.77± 2.71	11.38± 2.51	0.041*
Hct at admission	36.71± 8.59	36.47± 8.36	0.823*
Hct at discharge	33.43± 8.26	35.62± 6.59	0.018*
MCV at admission	85.88± 8.46	86.96± 8.49	0.406*
MCV at discharge	88.62± 5.77	86.73± 9.37	0.108*
RDW at admission	16.59± 12.76	15.24± 2.86	0.338*
RDW at discharge	16.13± 2.790	15.47± 2.813	0.012*
PLT at admission	235.87± 150.972	202.54± 117.77	0.068**
PLT at discharge	198.00± 136.63	211.21± 124.0	0.180**

Table 4. Continue				
CT-Scan Findings				
Ground-glass opacity	Positive	(83.1) 74	(77.1) 158	0.214†
Consolidation	Positive	(84.4) 76	(15.6) 14	0.527†
Pleural effusion	Positive	(35.9) 28	(64.1) 50	0.093†
Cardiomegaly	Positive	(35.0) 28	(24.4) 44	0.079†
Underlying Disease	Normal	(37.9) 36	(36.6) 81	0.031‡
	DM	(21.1) 20	(11.4) 24	
	HTN	(3.2) 3	(13.3) 28	
	IHD	(8.4) 8	(6.7) 14	
	COPD	(6.3) 6	(3.8) 8	
	Mixed	(23.2) 22	(26.2) 55	
CT-Score		10.18±5.42	8.97±5.69	0.026**

ESR: Erythrocyte sedimentation rate, CRP: C-reactive protein, LDH: Lactate Dehydrogenase, Cr: creatinine, BUN: Blood urea nitrogen, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, Bill-TD: Total Bilirubin WBC: white blood cell, Lymph: Lymphocyte count, Neut: Neutrophil count, Hb: Hemoglobin, Hct: Hematocrit, MCV: mean corpuscular volume, RDW: red cell distribution, PLT: platelet count, DM: diabetes mellitus, HTN: hypertension, IHD: ischemic heart disease, COPD: Chronic Obstructive Pulmonary Disease, CT: Computed tomography * Independent sample t-test, ** Mann–Whitney U test, †Chi square test, ‡Fisher exact test,

Association between Clinical Information, Laboratory Results, and Lung-CT Findings with Patient Outcomes

The clinical information, laboratory results, and lung-CT findings according to patients' outcomes (recovery/mortality) are presented in Table 5. Deceased patients were significantly more likely to have underlying diseases, mainly

Table 5. Association of demographic and laboratory parameters with the risk of mortality in patients with COVID-19

Lab results	Patients' Outcome		P-value
	Recovery Mean± SD	Mortality Mean± SD	
Age	62.45± 18.05	71.22± 16.96	<0.001*
ESR at admission	52.87± 32.55	53.72± 35.65	0.837**
ESR at discharge	26.6± 20.83	97.5± 43.66	<0.001**
CRP at admission	87.29± 78.21	103.75± 137.3	0.226**
CRP at discharge	35.7± 38.79	187.3± 89.36	<0.001**
Ferritin at admission	444.84± 309.22	691.9± 454.5	<0.001**
Ferritin at discharge	236.34± 168.22	1045.8± 499.91	<0.001**
LDH at admission	672.6± 420.16	835.7± 679.4	0.013**
LDH at discharge	543.8± 996.5	1453.32± 1264.26	<0.001**
Cr at admission	3.5± 2.12	1.98± 1.9	0.601**
Cr at discharge	1.42± 1.34	5.53± 3.17	<0.001**
BUN at admission	72.87± 58.70	92.21± 78.10	0.062**
BUN at discharge	56.69± 41.76	135.42± 83.64	<0.001**
AST at admission	92.68± 232.82	130.24± 486.70	0.753**
AST at discharge	46.4± 56.2	166.63± 331.47	<0.001**
ALT at admission	78.12± 244.29	66.96± 169.61	0.363**
ALT at discharge	89.30± 89.30	194.84± 194.84	<0.001**
ALP at admission	265.5± 265.57	481.01± 481.01	0.500**
ALP at discharge	249.78 ±192.28	346.01 ±272.58	<0.001**
Bill_TD at admission	1.19 ±6.85	0.72 ±1.85	0.203**
Bill_TD at discharge	1.74 ± 0.62	1.05 ± 2.23	<0.001**
WBC at admission	12.64 ±26.64	10.97 ± 8.78	0.203**
WBC at discharge	8.28 ± 13.96	13.96 ± 12.29	<0.001**
LYMPH at admission	18.74 ± 16.37	15.00 ±11.62	0.002**
LYMPH at discharge	21.38 ±26.01	10.81 ±11.08	<0.001**
NEUT at admission	75.35 ± 12.93	77.51 ± 14.70	0.026*
NEUT at discharge	71.79 ± 11.93	83.12 ± 11.38	<0.001*
Hb at admission	11.89 ± 3.03	12.03 ± 3.10	0.906*
Hb at discharge	11.56 ±2.37	10.60 ± 2.83	<0.001*
Hct at admission	36.41 ± 8.31	36.8± 8.7	0.752*
Hct at discharge	± 35.9 6.18	33.41± 8.51	0.001*
MCV at admission	86.55± 7.86	86.81± 9.58	0.907*
MCV at discharge	86.83± 5.79	88.14± 11.80	0.001*
RDW at admission	14.94± 2.60	16.9± 12.03	0.001*

Table 5. Continue				
RDW at discharge		15.17± 2.77	16.6± 2.7	<0.001*
PLT at admission		219.41± 130.76	202.02± 128.75	0.134**
PLT at discharge		235.8± 116.7	156.27± 130.14	<0.001**
CT-Scan Findings				
Ground-glass opacity	Positive	(73.0) 135	(88.7) 94	0.002†
Consolidation	Positive	(84.8) 156	(88.7) 94	0.354†
Pleural effusion	Positive	(24.4) 38	(35.4) 34	0.059†
Cardiomegaly	Positive	(21.2) 34	(38.8) 38	0.002†
Underlying Disease	Normal	(45.1) 87	(24.8) 27	<0.001‡
	DM	(13.5) 26	(16.5) 18	
	HTN	(14.5) 28	(2.8) 3	
	IHD	(7.3) 14	(7.3) 8	
	COPD	(3.6) 7	(6.4) 7	
	Mixed	(16.1) 31	(42.2) 46	
CT-Score		7.9±5.2	11.7±5.4	<0.001**

ESR: Erythrocyte sedimentation rate, CRP: C-reactive protein, LDH: Lactate Dehydrogenase, Cr: creatinine, BUN: Blood urea nitrogen, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, Bill-TD: Total Bilirubin WBC: white blood cell, Lymph: Lymphocyte count, Neut: Neutrophil count, Hb: Hemoglobin, Hct: Hematocrit, MCV: mean corpuscular volume, RDW: red cell distribution, PLT: platelet count, DM: diabetes mellitus, HTN: hypertension, IHD: ischemic heart disease, COPD: Chronic Obstructive Pulmonary Disease, CT: Computed tomography * Independent sample t-test, ** Mann–Whitney U test, †Chi square test, ‡Fisher exact test,

mixed conditions (42% vs 16%, P<0.001). Ground glass opacity (88.7% vs. 73%, P=0.002) and cardiomegaly (38.8% vs 21.3%, P=0.002) were more common in those deceased patients compared with recovered ones. The CT score was significantly higher in patients who passed away (P<0.001). Laboratory markers such as ESR (P<0.001), CRP (P<0.001), Ferritin (P<0.001), LDH at admission (P=0.013) and at discharge (P<0.001), Cr at discharge (P<0.001), BUN at discharge, Urea at discharge (P<0.001), AST at discharge (P<0.001), ALP at discharge (P<0.001), Neut at admission (P=0.026), Neut at discharge (P<0.001), Lymph (P<0.001), Hb at discharge (P<0.001), Hct at discharge (P<=0.001), RDW (P<0.001), and PLT (P<0.001) were also significantly higher in expired patients.

Discussion

The present study underscores the significance of lung CT-scans and laboratory findings in predicting disease outcomes in COVID-19 patients. Notably, our findings corroborate previous studies highlighting the value of CT imaging in detecting radiological features of COVID-19 before clinical onset, thereby facilitating early diagnosis in patients with negative RT-PCR tests (9, 10)(11). Moreover, the high sensitivity of CT scans makes it an excellent modality for detecting COVID-19, especially in older adults (10). Consistent with previous research, our study revealed a strong association between lung CT-scan findings and patients' mortality rate, with ground-glass opacity and cardiomegaly being more prevalent in deceased patients compared to those recovered.

Two major CT findings in COVID-19 patients were ground-glass opacity and consolidation, which are comparable to those observed in SARS and MERS patients (10, 12-16). Moreover, this study showed a direct association between CT score and ICU admission requirements as well as patients' outcomes during their hospital stay. This is consistent with a previous study showing that the CT score is often higher in deceased greater consolidation opacities on their chest CT scans (17).

Recent studies have revealed that older age and concurrent underlying diseases might be potential risk factors for poor COVID-19 outcomes (14, 18-20). Diabetes, for instance, is associated with a compromised immune system, leading to severe viral and bacterial infections. Similarly, new cardiovascular disease cases may experience prolonged COVID-19 infection and increased mortality rates. Obesity, a history of cardiovascular disorder, hypertension, and smoking are also increase the risk of severe COVID-19 infections. Moreover, COVID-19 is a leading causes of cardiac diseases such as myocarditis and acute heart failure (21). The present study also revealed a significant direct association between age and concurrent underlying diseases with both ICU admission requirements and mortality in COVID-19 patients. This is consistent with previous studies by Chen et al. (22), Kang et al. (23), and Zhang et al. (24), which reported similar findings. In a study conducted by Choi et al. (25), the mortality rate of immunosuppressed patients or those with chronic obstructive pulmonary disease, diabetes, hypertension, CKD, and cardiac diseases was 2.5-4 times greater than the normal population.

In terms of laboratory parameters, this study

revealed tha ESR, CRP, LDH, Ferritin, WBC, neutrophil count, and LDH were significantly higher in both ICU-admitted and deceased patients. Higher LDH levels are indicative of greater cell damage and a weaker immune response, leading to severe viral infections. CRP is an acute-phase reactant protein produced in inflammatory conditions such as severe infections. Our findings are consistent with those of Akdogan et al. who reported higher CRP and LDH levels among patients with severe COVID-19 infection and lung lesions in the early stages of the disease (26). Ferritin also reflects the iron storage levels and is correlated with macrophage activation. It acts as an acute phase reactant and elevates during viral infections, including influenza. Our results are consistent with those of Deng et al. who showed that ferritin is a predictor factor of mortality in ICU-admitted patients with COVID-19 (27).

Moreover, lower Hb, Hct, and lymphocyte count were observed in ICU-admitted patients and those who passed away during their hospital stay. Cytokine-induced reactions in viral infections are the leading cause of lymphopenia. Our findings, are consistent with a systematic review and meta-analysis showing a significant correlation between both ICU admission requirements and mortality rate with baseline laboratory measurements, including WBC, ESR, LDH, and Lymphocyte count (28). Similarly, In another study by Güngörer et al. (29), age, higher LDH, ferritin, and lower lymphocyte count were significant predictors of ICU admission requirements in covid-19 patients. Additionally, CRP, Hb, PLT, Cr, and Neutrophil to lymphocyte ratio were also related to both ICU admission and mortality rate in a cohort of over 3000 patients with COVID-19 (30).

These findings suggest that a combination of laboratory and radiological markers can be useful in predicting patient outcomes in COVID-19. The early identification of these markers may help clinicians to initiate prompt and effective interventions, thereby improving patient outcomes. The presence of underlying diseases and comorbidities can also play a crucial role in determining disease severity and patient outcomes. Therefore, it is essential to consider these factors when developing treatment strategies for COVID-19 patients.

Conclusion

In conclusion, this study provides new insights into the association of CT-scan findings and laboratory parameters with disease outcomes in patients with COVID-19. The combination of laboratory markers and CT-scan findings may serve as strong predictors for identifying patients at high risk of ICU admission and mortality. Future studies are required to focus on validating these findings in larger cohorts and exploring the potential use of these biomarkers as prognostic tools for COVID-19.

Conflict of interest

The authors declare no conflicts of interest regarding the publication of this paper.

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