

## Original Article

# Evaluation of the Clinical, Laboratory and Imaging Findings of Patients with COVID-19 and Their Associations with Clinical Outcomes in an Iranian Hospital: A Cross-Sectional Study

Shabnam Tehrani<sup>1</sup>, Davood Yadegarinia<sup>2</sup>, Sara Abolghasemi<sup>2</sup>, Shahnaz Sali<sup>2</sup>, Alireza Abrishami<sup>3</sup>, Hamideh Moradi<sup>1</sup>, Neda Khabiri<sup>1\*</sup>

<sup>1</sup>Labbafinejad Clinical Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>2</sup>Infectious Diseases and Tropical Medicine Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>3</sup>Department of Radiology, Shahid Labbafinejad hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

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## Abstract

**Background:** Coronavirus disease 2019 (COVID-19) is a concern in the medical community as the virus spreads around the world. It has a heavy global burden, particularly in low-income countries. This virus has its specific outcomes in each population. Hence, it is necessary to design studies to find the epidemiological behaviour of this virus.

**Materials and Methods:** This cross-sectional study was conducted in the Labbafinezhad hospital, Tehran, Iran. Demographic features include age, sex, past medical history, drug history, habitual file, influenza vaccination history, recent exposure history, clinical symptoms or signs, and the recorded symptoms. The clinical examination and para-clinical assessment, including chest computed tomography (CT) and laboratory testing on admission, were recorded.

**Results:** It was found that patients with a history of kidney transplantation, high level of LDH, high level of AST, and increased neutrophil to lymphocyte ratio are most at risk of death.

**Conclusion:** Parameters mentioned could help practitioners predict patient outcomes, and necessary interventions could be considered in this regard.

**Keywords:** COVID-19, SARS-CoV-2, Epidemiological study, Coronavirus

\*Corresponding Author: Neda Khabiri M.D, Labbafinejad Clinical Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Email: dr.neda\_khabiri@yahoo.com

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## Introduction

Coronavirus disease 2019 (COVID-19) is a family of large enveloped non-segmented positive-sense RNA viruses in the same subgenus with severe acute respiratory syndrome CoV (SARS-CoV) but a different clade. It was first reported in December 2019 in Wuhan, China, with a cluster of unexplained pneumonia that soon turned into a global pandemic<sup>1</sup>.

The CoVs have become the significant pathogens of emerging respiratory disease outbreaks. According to the World Health Organization (WHO) website, as of June 29, 2020, COVID-19 has caused 10 021 401 confirmed cases and 499 913 confirmed deaths<sup>2</sup>.

In Iran, it was first reported in Qom province on February 19, 2020, which soon rapidly spread over all the provinces of the country<sup>3</sup>. As of June 29, 2020, a total of 225 205 confirmed cases and 10 670 confirmed

death had been documented in Iran. Of note, in recent weeks, the second wave of the infection has been encountered in Iran as a rapid surge in the numbers of COVID-19 cases, and the mortality rate has been evident.

The COVID-19 could affect all the age groups. Despite the initial impression that children are immune, many disease cases are reported at a younger age<sup>4,5</sup>. Following an incubation period of 2-14 days, non-specific symptoms such as malaise, fever, and dry cough will appear. Depending on the patient's immunity system level and concurrent comorbidities, the symptoms might remain mild or lead to severe pneumonia, acute respiratory distress syndrome, and eventually multiple organ damage and even death<sup>6-8</sup>. Although the main symptoms are confined to the respiratory system, non-respiratory complications such as the intestinal tract, renal, hepatic, cardiovascular system, central and peripheral nervous system, and lymphocytopenia have been reported<sup>8,9</sup>. Additionally, the main para-clinical features include leukocytosis, lymphopenia, elevated C-reactive protein (CRP), and evidence of ground-glass opacity on chest computed tomography (CT)<sup>10</sup>.

In clinical management, several investigational therapeutics such as hydroxychloroquine, azithromycin, ribavirin, interferon, lopinavir-ritonavir, remdesivir, favipiravir, and corticosteroids have been used. However, the efficacy of these drugs remains controversial<sup>11-13</sup>. Given the increasing pattern of COVID-19 and lack of epidemiological study on COVID-19 in Iran, herein, we aimed to investigate the clinical, para-clinical features and medical approaches in a selected group of patients in Labbafinezhad Hospital to contribute to a better understanding of the nature of the disease.

## Methods

**Study design:** This cross-sectional study was conducted from March 01, 2020, to April 30, 2020, in the Labbafinezhad hospital, Tehran, Iran. The study was approved by the local ethics committee (Code: IR.SBMU.RETECH.REC.1399.100). Besides, written informed consent was obtained from all patients before they participated in this study.

**Study population:** This is a newly emerging pandemic pertained to COVID-19. We had to enroll

all the patients with COVID-19 referred to our center who fulfilled the inclusion criteria consisting of patients with laboratory-confirmed COVID-19 who were hospitalized in our center according to our national treatment protocol.

COVID-19 was diagnosed based on the WHO interim guidance<sup>14</sup>. A confirmed case of COVID-19 was defined as a positive result on the real-time reverse-transcriptase-polymerase-chain-reaction (RT-PCR) assay of nasopharyngeal swab specimens.

**Data gathering:** Following the hospitalization of patients, the data collection was performed by a checklist consisting of demographic features like age, sex, past medical history, drug history, habitual file, influenza vaccination history, recent exposure history, clinical symptoms or signs, and the duration of the symptoms. The clinical examination and para-clinical assessment, including chest computed tomography (CT) and laboratory testing on admission, were recorded.

Laboratory assessments consisted of a complete blood count, blood chemical analysis, coagulation testing, liver and renal function assessment, and measures of electrolytes, C-reactive protein, vitamin D, troponin, and creatine kinase. Clinical examination included a vital sign and systemic examination. (We defined the severity of the disease based on the guideline on COVID-19 issued by the Iranian National Health Commission.)

Consequently, the patients underwent medical treatment according to the national treatment protocol. The chest CT was repeated on the fifth day of hospitalization.

We eventually retrieved the patients' clinical profile, including medication regimen with the type, dosage, and duration of the therapy, the systemic examination on the second and fifth day of hospitalization, duration of the hospitalization, the prognosis of the disease, and the mortality rate.

**Statistical analysis:** After data collection, the statistical analysis was performed using SPSS software version 22.0. For descriptive analysis, continuous variables were presented as medians and compared by the Mann-Whitney U test. Categorical variables are presented as numbers and percentages and were compared by chi-square or Fisher exact test. A two-side *P*-value  $0 < 0.05$  was considered statistically

significant.

## Results

This study evaluated the records of 230 patients diagnosed with SARS-CoV-2 infection, and some necessary variables were extracted. The demographic information, clinical characteristics, laboratory results, therapeutic interventions, and outcomes of patients were extracted. The median age of patients was 58 years old (interquartile 48-72 years). 137 (59.6%) of patients were also male. Hypertension (39.1%), diabetes mellitus (32.6%), and cardiovascular diseases (22.7%) were the most common underlying diseases among the patients. 134 (58.26%) of patients had at least one underlying disease. 19 (8.3%) patients also had a history of kidney transplantation and were taking immunosuppressive agents. Angiotensin-converting enzyme inhibitors also were used by 14 (6.1%) of patients. These results are also categorized according to the final clinical outcome and are presented in Table 1.

As seen in Table 1, those elder patients ( $P=0.040$ ) with diabetes ( $P=0.019$ ), hypertension ( $P=0.027$ ), and lung diseases ( $P=0.037$ ) had significantly more mortality.

The results of initial clinical symptoms at the admission time showed that Dyspnea (66.1%), cough (55.7%), and myalgia (34.3%) were the most frequent

symptoms. Headache (5.7%) and sore throat (0.4%) were seen with less frequency. These results are also categorized according to the final clinical outcome and are presented in Table 2. As seen in Table 2, there were no statistical differences between surviving and non-survive groups in terms of initial clinical symptoms (all  $P$  values  $> 0.05$ ).

The laboratory results of patients are also summarized in Table 3. Laboratory parameters including LDH, Creatinine, AST, ALT, and neutrophil to lymphocyte ratio were statistically different between surviving and non-survived groups.

The results of hospitalization also showed that the median time of hospitalization in survived patients was 7 (5-11) days and in on-survived patients was 9 (5-14) days ( $P=0.129$ ).

Using linear regression and stepwise approach, all variables were entered to find a model to predict mortality. It was found that patients with a history of kidney transplantation, high level of LDH, high level of AST, and increased neutrophil to lymphocyte ratio are primarily at risk of death. The summary of the proposed model is shown in Table 4.

**Table 1:** The demographic characteristic of patients in this study.

Variables	Survived (n= 50)	Non-survived (n= 180)	P value
Age (years)	58 (47-71)	62 (53-77)	0.040
Male	99 (43.0 %)	36 (15.7)	0.177
Diabetic	52 (22.60 %)	23 (10 %)	0.019
Hypertension	64 (27.8 %)	26 (11.3 %)	0.027
Lung diseases	13 (5.7 %)	0 (0.0 %)	0.037
Chronic kidney diseases	21 (9.1 %)	10 (4.3 %)	0.101
Cardio vascular diseases	37 (16.2 %)	15 (6.6 %)	0.116
Kidney transplanted	12 (5.2 %)	7 (3.0 %)	0.089
Angiotensin converting enzyme inhibitors usages	8 (3.5%)	5 (2.2 %)	0.284

**Table 2:** The initial symptoms of patients in this study.

Symptoms	Survived (n= 50)	Non-survived (n= 180)	P value
Fever	94 (40.9%)	27 (11.7%)	0.476
Sore throat	1 (0.4%)	0 (0.0%)	0.783
Myalgia	64 (27.8%)	15 (6.5%)	0.289
Cough	99 (43.0%)	29 (12.6%)	0.0416
Dyspnea	114 (49.6%)	38 (16.5%)	0.064
Headache	10 (4.4%)	3 (1.3%)	0.572
Gastrointestinal symptoms	23 (10.1%)	6 (2.6%)	0.560

## Discussion

This study aimed to find a clinical-epidemiological model for predicting the mortality among the SARS-CoV-2 infection. In this regard, the medical records of 230 patients were evaluated retrospectively. Clinical and para-clinical data were gathered, and the results showed that AST level, LDH level, neutrophil to lymphocyte ratio, and kidney transplantation are predictor indicators for mortality.

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first identified in patients with severe pneumonia in Wuhan, China, in late 2019. The

clinical presentations of this disease are different according to the stage of the disease, which could affect the prognosis. Also, the laboratory and imaging findings and an underlying condition have their particular prognostic value.

The dominant clinical features of COVID-19 were fever, cough, Dyspnea, and myalgia, while other symptoms were rare. Dyspnea was an acute clinical symptom that can determine clinical outcomes. Patients with Dyspnea at the time of admission had a poor clinical outcome compared to those with upper respiratory tract symptoms.

Different studies investigated the underlying diseases in

**Table 3:** The laboratory results of patients in this study.

Variables	Survived (n= 50)	Non-survived (n= 180)	P value
Median (IQR)			
WBC	6.10 (4.70-8.30)	7.10 (4.90-10.00)	0.177
Hb	13.30 (12.10-14.60)	12.90 (11.80-14.32)	0.282
PLT	190.00 (153.00-235.00)	195.50 (135.00-264.00)	0.908
CRP	40.00 (27.00-50.00)	40.00 (31.00-57.00)	0.217
LDH	441.00 (341.00-556.00)	794.00 (590.00-1253.00)	< 0.001
Cr	1.17 (1.00-1.40)	1.51 (1.10-2.71)	<0.001
AST	30.00 (23.00-45.00)	50.00 (31.00-80.00)	<0.001
ALT	24.00 (16.00-42.00)	32.00 (19.00-59.00)	0.040
N-L ratio	3.24 (1.86-5.30)	4.78 (3.31-8.80)	<0.001

**Table 4:** The statistical model of COVID-19 associated factors.

Coefficients <sup>a</sup>					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.123	.078	-	27.077	.000
LDH	-.001-	.000	-1.308-	-5.333-	.000
AST	.002	.000	1.022	4.160	.000
N_L	-.021-	.009	-.193-	-2.321-	.022
KT	-.293-	.143	-.171-	-2.043-	.044

a. Dependent Variable: Mortality

patients with COVID-19. Patients with at least one comorbidity, or even more, were associated with poor prognoses. This result is different from reported results in the MERS and SARS. The risk between cardiac diseases and poor clinical outcomes of influenza, SARS, or MERS infections was inconclusive.

The most frequently reported laboratory abnormalities were lymphopenia and elevated CRP compatible with previous reports of patients with COVID-19. However, all these laboratory indicators are non-specific, which makes their clinical application limited. In the Evaluation of suspected cases, physicians cannot rely on these laboratory abnormalities to exclude or confirm the diagnosis of COVID-19.

## Conclusion

Above mentioned parameters could help the practitioners predict patient outcomes, and necessary interventions could be considered.

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