Tabari Biomedical Student Research Journal

OPEN ACCESS

ORIGINAL: The Relationship between CT Severity Infections and Oxygen Saturation with Outcomes in Patients Infected with COVID-19

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ARTICLE INFO

Submitted: 10 Sep 2024
Accepted: 18 Oct 2024
Published: 11 Nov 2024

Keywords:
COVID-19;
Iran;
Oxygen saturation;
Complication;
CT scan

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Citation:
Shirvani M, Shakiba M H, Kanjouri S, Pashazadeh N, Fakhredini K. The Relationship between CT Severity Infections and Oxygen Saturation with Outcomes in Patients Infected with COVID-19. Tabari Biomed Stu Res J. 2024;6(4):36-41.

10.22034/6.4.36

ABSTRACT

Introduction: SARS-CoV-2 induced the novel coronavirus disease (COVID-19), which is the most important medical concern in the last century. COVID-19 affects multiple organs and caused different complications. The purpose of this study is to describe the relationship between CT severity infections and oxygen saturation with outcomes in patients infected with COVID-19.

Material and Methods: This cross-sectional study was performed on 350 patients with COVID-19 infection admitted to Farabi Hospital, affiliated with Kermanshah University of Medical Sciences (KUMS), Kermanshah Province, Iran. Clinical and laboratory data as also CT scan involvement and blood oxygen saturation were obtained from the patient's medical records and reviewed by a trained nurse and medical doctor.

Results: Of the 350 patients, 178 (50.9%) were male, and 172 (49.1%) were female. The main age was 63.95±19.58 years. The results showed no significant relationship between age, gender, and patient disease outcome. However, there was a significant relationship between lung involvement in CT scan, SpO2, underlying diseases, and patient disease outcomes. HTN+CHF, DM, and HTN+CVA diseases were more frequent among patients. The most common symptom among the patients was fever.

Conclusion: It was concluded that the level of blood oxygen saturation (SpO2), history of underlying diseases and symptoms of fever, shortness of breath, loss of consciousness, and intensity of conflict CT scan of the lung in patients with the disease of COVID-19, the probability of mortality it increases the risk of this disease and plays a significant role in determining the prognosis of the disease.

Introduction

On 31 December 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which causes covid-19, firstly was reported to World Health Organization (WHO) as pneumonia of unknown cause in Wuhan, Hubei Province, China (1). By 12 April 2020, more than 1.8 million cases and 110 000 deaths were reported across the world, affecting 185 countries (2). Nowadays, the number of cases and deaths is still increasing, and COVID-19 prevalence has become a global pandemic.

COVID-19 affects multiple organs and caused complications such as pneumonia, disorder in renal and liver functions, cardiac injuries, etc. (3-5). An early study reported that approximately 12% of patients with COVID-19 infection suffered from cardiac conditions (6). The purpose of this study is to describe the relationship between CT severity infections and oxygen saturation with outcomes in patients infected with COVID-19 admitted to Farabi Hospital in Kermanshah.

Methods

Setting and Design

This cross-sectional study was conducted at Farabi Hospital, affiliated with Kermanshah University of Medical Sciences (KUMS), Kermanshah Province, Iran. A total of 350 patients with COVID-19 infection between December 1st, 2020 and June 30th 2021, with convenience sampling were enrolled. In this study, patients with incomplete information were excluded.

Data collection

Clinical and laboratory data as also CT scan involvement and blood oxygen saturation were obtained from the patient's medical records and reviewed by a trained nurse and medical doctor. First, several baseline characteristics including age, sex, comorbidities, and treatment were recorded. To determine the severity of lung involvement in a CT scan, each lobe of the lung can be assigned a score between 0 and 5 based on the percentage of involvement. In such a way that: Score zero (no lobe involvement), score 1 (less than 5% involvement), score 2 (5 to 25% involvement), score 3 (26 to 49% involvement), score 4 (50 to 75% involvement), and score 5 (more than 75 percent involvement). Finally, the intensity index of the CT scan is determined based on the total score related to the involvement of all lobes as follows: mild (total score 1 to 8), moderate (total score 9 to 15) and severe (total score more than 15).

Statistical Methods

Data were analysed using descriptive statistics including mean ± standard deviation (SD), median, frequencies and percentages wherever applicable. Multivariable logistic regression model was used to analyse of factors predicting death in COVID-19 patients. A test was considered statistically significant if the probability value (P-value) was less than 0.05. All analyses were carried out using Stata software (version 14.1) (Stata Corp, College Station, TX, USA).

Ethics

The Research Ethics Committee at the Deputy of Research of KUMS approved the study protocol in January 2020 (IR.KUMS. MED.REC.1401.012). In addition, the participants were given a participant information statement and signed a written consent form. Individual personal information was kept confidential.

Results

Of the 350 patients, 178 (50.9%) were male, and 172 (49.1%) were female. The main age was 63.95±19.58 years. The results showed no significant relationship between age, gender, and patient disease outcome. However, there was a significant relationship between lung involvement in CT scan, SpO2, underlying diseases, and patient disease outcomes. HTN+CHF, DM, and HTN+CVA diseases were more frequent among patients. The most common symptom among the patients was fever. Details are shown in **Table 1**.

Table1

Variable	Subgroup	Disease outcome (n / Mean ± SD)		p-value
		Death	Recovery	
Age	-	65.08 ± 20.09	63.72 ± 19.50	0.627
Gender	Male	35 (59.32 %)	143 (49.14 %)	0.099
	Female	24 (40.67 %)	148 (50.85 %)	

Table1 Continue

Lung involvement in CT scan	No involvement		3 (5.08 %)	3 (1.03 %)	0.132
	Mild		23 (38.98 %)	132 (45.36 %)	
	Moderate		18 (30.50 %)	101 (34.70 %)	
	Involvement		15 (25.42 %)	55 (18.90 %)	
SpO2	-		76.52 ± 10.97	87.87 ± 7.69	0.001
Covid-19 RT-PCR	Positive		10 (16.94 %)	63 (21.64 %)	0.268
	Negative		49 (83.05 %)	228 (78.35 %)	
Underlying diseases	Yes		17 (28.81 %)	47 (16.15 %)	0.021
	No		42 (71.18 %)	244 (83.84 %)	
Clinical symptoms	Cough	No	35 (59.32 %)	184 (63.23 %)	0/336
		Yes	24 (40.67 %)	107 (36.76 %)	
	Sputum	No	42 (71.18 %)	198 (68.04 %)	0.379
		Yes	17 (28.81 %)	93 (31.95 %)	
	Fever	No	48 (81.35 %)	267 (91.75 %)	0.019
		Yes	11 (18.64 %)	24 (8.24 %)	
	Dyspnea	No	26 (12.14 %)	63 (46.32 %)	0.017
		Yes	188 (87.85 %)	73 (53.67 %)	
	Hemoptysis	No	58 (98.30 %)	279 (95.87 %)	0.325
		Yes	1 (1.69 %)	12 (4.12 %)	
	Syncope	No	51 (86.08 %)	286 (98.28 %)	0.001
		Yes	8 (13.55 %)	5 (1.71 %)	
Hospitalization	-		8.91 ± 6.13	8.46 ± 6.06	0.606

Discussion

The aim of the present study is to determine the relationship between the level of involvement of the CT scan, oxygen level, blood, and COVID-19 PCR test and the outcome of hospitalized patients with COVID-19 at Farabi Hospital in Kermanshah. Our research method was descriptive-analytical with a cross-sectional approach, and the target population included all patients with COVID-19 admitted to Farabi Hospital in Kermanshah during the first six months of 2021. The statistical sample consisted of 350 of these people, who were selected by accessible and random sampling. In the current chapter, along with a brief overview of the purpose, the research problem, and the work method, the conclusion and discussion section, based on the results of the tests, was discussed. The outcome of the disease in patients with COVID-19 admitted to the hospital was revealed by the results from the previous chapter of the current study, which aimed to determine the relationship between characteristics and demographics: the mean and standard deviation of the age of patients who died were 65.08± 20.098 years old, and those who recovered were 63.725 ±19.505 years old. Also, the number of hospitalized COVID-19 patients who recovered was 143 men and 51 women, and 35 men and 24 women died. Data analysis showed no significant difference between the age and gender of people and the disease outcome in hospitalized COVID-19 patients.

Zieleskiewicz et al. (2020) conducted a study in which they investigated the effect of lung ultrasound and chest CT scan on the severity of COVID-19 pneumonia in 100 patients with COVID-19 with an average age of 61 years, of whom 65% were men. This research showed a non-significant relationship between the age and gender of the patients with the severity of the disease. Also, the results obtained in this study showed that a CT scan of the chest is a tool with high sensitivity and specificity for assessing the severity of COVID-19(7).

"The relationship between chest CT scan findings and laboratory findings and the severity of the disease of COVID-19" was the title of a single-center study by Zanganeh et al. in 2022. Examines were performed on 197 confirmed COVID-19 patients. The respondents to the poll had an

average age of 60.3 and 18.6 years, and 54.8 percent were male. Lung CT scan findings and laboratory results help classify disease prognosis and help to manage this disease. The findings obtained in this research showed that lung involvement of more than 75% and polymorphonuclear count variables were positive predictors of the disease. In fact, per unit Increase in the severity of lung involvement and the number of polymorphonuclear cells, the severity of the disease is 27.1 and increases by 43.8 percent (8).

Haghighi et al., in a research study titled Examination of epidemiological and paraclinical findings, performed imaging of patients with COVID-19 hospitalized in the special care department of Rasht hospitals in March 2018, in which there were 138 patients with COVID-19 with an average age of 88.62 ± 42.13 years. The findings of this research showed that the mortality rate in patients with severe manifestations of the disease, old age, history of underlying disease, symptoms of shortness of breath, cough, fever, and extensive lung involvement in imaging and changes in laboratory results despite drug, treatment and ventilation Mechanical is high (9).

The research titled investigating the relationship between CT engagement intensity scoring system, Chest scan with blood oxygen saturation, and laboratory markers of inflammation in adult patients with COVID infection was done in 2022. Researchers examined the number of 305 patients with COVID-19 with an average age of 9.41 1.9, 8/33% of whom were women. The results obtained in this research showed that a CT scan of the chest is a powerful tool in predicting the extent and severity, and the positivity of the laboratory markers of inflammation and the capillary blood oxygen saturation has a positive and significant relationship in terms of statistical analysis (10).

Another study was conducted in 2022 titled: Investigating the Relationship between the Severity of CT scan involvement and capillary blood oxygen saturation in Patients with COVID-19 Infection. Qadir et al. examined 105 patients with COVID-19 infection, 40% of whom were women. The findings obtained in this research showed that, based on CT scan findings, there is a positive and significant relationship between disease severity and capillary blood oxygen saturation in patients with COVID-19 infection (11).

In examining the study's objectives, the results obtained to determine the relationship between the history of background diseases and disease outcomes in hospitalized COVID-19 patients showed a positive and significant relationship between the mentioned variables in terms of statistical analysis. Also, the findings aim to determine the relationship between clinical symptoms and the disease outcome. COVID-19 patients were admitted to the hospital, which showed that among the symptoms of the disease, such as fever, tightness, Shortness of breath, loss of consciousness, and the outcome of the disease in COVID-19 patients admitted to the hospital have significant in terms of the statistical tests performed. Finally, the review of the results obtained in hospitalized COVID-19 patients showed no significant relationship between the duration of hospitalization and the outcome of the disease in COVID-19 patients.

Canova et al. (2021) conducted cohort research to ascertain how the results relate. According to the objectives and presumptions of their study, they studied the role of laboratory tests and a chest CT scan in predicting the severity of the COVID-19 condition in 866 individuals, 432 of whom were over 60. The results obtained in this research showed that lung lesions caused by SARS-Cov-2 infection with increased inflammatory response and impaired respiratory gas exchange play an important role in pathogenesis and clinical manifestations (12).

Lung damage in hospitalized patients with COVID-19 infection and 30-day mortality in them were the topics of a study by Charpentier et al. in 2021. The study involved 210 patients with COVID-19, with an average

age of 66.16 and a 69.5% male population. The findings of this study demonstrated a statistically significant and positive correlation between the degree of lung damage shown on the chest CT scan of patients with COVID-19 and the 30-day death rate. This implies that the death rate also rises as the lung damage score rises (13). Leonardi and colleagues examined 189 patients with an average age of 61 for their study, "Examining the role of CT scan chest in predicting severe disease in patients with pneumonia COVID-19," published in 2020. The study's conclusions suggest that a chest CT scan can be a valuable tool for assessing the severity of an infection and deciding whether a patient might benefit from mechanical ventilation (14).

In a study conducted in 2021 by Salvatore et al., 103 individuals were examined to ascertain the clinical observations, laboratory findings, and quantitative assessment of lung involvement in patients infected with COVID-19 to predict their prognosis. Based on information gleaned from patient CT chest scans, the study's findings showed that COVID-19 is recognized as an independent predictor for calculating the severity and effects of the disease in pneumonia (15).

Finally, Aalinezhad et al. examined 270 patients with COVID-19 in a study titled "Investigating the Relationship between CT scan severity scores and Capillary blood oxygen saturation in Patients with COVID-19 Infection," which was completed in 2021. According to statistical analysis, the results of this study revealed an inverse and significant relationship between the severity of chest CT scan involvement and capillary blood oxygen saturation in patients with COVID-19 pneumonia. The lower the capillary blood oxygen saturation (SpO2), the greater the CT scan involvement (16).

Conclusion

According to the results obtained in our study and comparing it with the results of other studies, It was determined that the level of blood oxygen saturation (SpO2), history of underlying diseases and symptoms of fever, shortness of breath, loss of consciousness, and intensity of conflict CT scan of the lung in patients with the disease of COVID-19, the probability of mortality it increases the risk of this disease and plays a significant role in determining the prognosis of the disease.

Acknowledgments

The authors thank the Farabi Hospital, Kermanshah University of Medical Sciences, Kermanshah, Iran, for their support, cooperation, and assistance throughout the study.

Conflicts of interest

Authors have no conflict of interests.

Authors' contributions

M.Sh and N.P conceived of the presented idea.
K.F and S.K verified the analytical methods.
Both M H.Sh and K.F authors contributed to the final version of the manuscript.
M.Sh supervised the project.
All authors provided critical feedback and helped shape the research, analysis and manuscript.

Funding

This research received no external funding.

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