Comparison of Clinical, Radiological and Laboratory Findings in Discharged and Dead Patients With COVID-19 in Ilam Province, West of Iran

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Research Article

Keywords: COVID-19, Ilam, clinical, SARS-CoV-2, Iran, laboratory

Posted Date: November 9th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-1049149/v1

Abstract

Objective: COVID-19 is the last global threat which WHO confirmed it as a pandemic on March 11, 2020. In the Middle East, Iran was the first country where the SARS-Cov-2 was detected. The epidemiological and economic challenges of Iran make this country a particularly relevant subject of study. In the current study, we aimed to evaluate the clinical, radiological and laboratory findings in hospitalized COVID-19 confirmed cases in Ilam province, west of Iran.

Material and methods:

Overall, 2204 hospitalized RT-PCR confirmed patients with COVID-19 were considered in this study. Electronic medical records, including clinical symptoms, radiological images, laboratory findings, and the comorbidities of patients with COVID-19 were collected and analyzed. In addition, the medication regimens used in these patients were evaluated. The patients were classified in discharged and died groups according to their outcomes. Then, clinical, radiological and laboratory findings as well as treatment regimens and underlying diseases were compared in these two groups.

Results:

Among the patients, 1209 (54.85%) were male and 995 (45.14%) were female. Pneumonia, dyspnea and cough, were the most common clinical data in both discharged and died groups. Among the comorbidities, COPD, and cancer were significantly more common in the dead patients than in the living. The results of laboratory tests showed that blood creatinine, BUN, ESR, Na+, WBC, and neutrophil count have increased in deceased group compared to the survivors. However, the lymphocyte count decreased in deceased patients. The evaluation of radiographs demonstrated that there were significant correlations between bilateral pneumonia, ground glass opacity, bilateral patch**y** shadowing, and pleural effusion with death.

Conclusion:

The current investigation indicated the special profile of COVID-19 in west of Iran. Discharged and dead patients with COVID-19 had distinct clinical, radiological and laboratory features, which were separated by principle component analysis. Identifying these characteristics of the disease would translate into the implementation of practical measures to improve results.

Introduction

In December 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causative agent of coronavirus disease 2019 (COVID-19) infected a large number of people in Wuhan, China. This RNA virus from coronaviruses family can give rise to respiratory tract infections of different severities. SARS-CoV-2 infection varies from the normal cold to more serious conditions and is similar to the coronavirus, a main

cause of SARS. SARS-CoV-2 has also been demonstrated to have a strong affinity to human respiratory receptors.

In recent years, global attention has been drawn to COVID-19 due to the fast growing number of new cases, as well as its transmission via human to human interaction through droplets, contacts, and aerosols (1, 2). COVID-19 has become a worldwide concern and a significant public health challenge, particularly since the rapid escalation of the infected cases and affected countries.

On March 11, 2020, COVID-19 was declared as a pandemic by the World Health Organization (WHO) (3). Unlike SARS-CoV and Middle East Respiratory Syndrome (MERS)-CoV, the spread of SARS-CoV-2 is greater. In the same year, Iran was reported as one of the countries with the highest prevalence rate of cases so that it was severely hit by the severity of the virus. The first COVID-19 case recorded officially in the country (Qom province) dated on 19 February 2020 (4). In view of the fact that Iran was the first country in the Middle East where the virus was identified, it is speculated that this country is responsible for the transmission of the disease in neighboring countries, such as Iraq, Pakistan, and Afghanistan. Owing to the epidemiological conditions and the complexity of the political and economic difficulties, Iran is taken into account as a particular subject of study (5).

For the COVID-19, there are no specific clinical features but may range from no symptoms (asymptomatic cases) to severe pneumonia and death. The patients are often manifested with fever, cough, dyspnea, rhinorrhea, headache, myalgia, and arthralgia (6). Some SARS-CoV-2 infected patients also develop the severe complications of COVID-19, including acute respiratory distress syndrome (ARDS) and death; however, the reason for such behavior is unknown. Development of severe COVID-19 disease depends on multiple risk factors, comprising of sociodemographic factors and comorbid conditions (7, 8).

Identification of the epidemiological, clinical and laboratory features of COVID-19 could contribute to proper decision making in the control of this epidemic disease. The present study was conducted with the aim of analyzing the epidemiological and clinical attributes of COVID-19 patients following the diagnosis of the disease by detecting the viral nucleic acid using RT-PCR.

Materials And Methods

Study design

We conducted the present single-center retrospective descriptive study. The study was carried out on COVID-19 cases hospitalized in Shahid Mostafa Khomeini Hospital (Ilam, Iran) and approved by the COVID-19 registry system of the Ilam University of Medical Sciences (code: A-10-2579-5). The approach to the disease was in accordance with the guidelines provided by Iran National Health and adapted from the WHO guidelines, as well as based on the latest studies on COVID-19 (9).

Inclusion/Exclusion criteria

All patients who were hospitalized from 20 April 2020 to 21 May 2021 and their clinical, laboratory, and radiological information were available at the registration center were included in the study. Patients whose demographic data, laboratory tests, clinical signs, and/or radiological findings were not available in the registry system were excluded from the study. Also, pregnant patients and patients with hematological disorders were not included in the study.

Ethical considerations

The protocols of this study were approved by the Ethics committee of Ilam University of Medical Sciences and accomplished in conformity the ethical principles of the declaration of Helsinki. Written informed consents were received from all the patients, and their information was kept confidential.

Clinical assessment

Cases with fever, rhinorrhea, sore throat, cough, and probable respiratory distress were considered as patients with suspected COVID-19, particularly if they had a positive history of close relationship with a highly suspected or confirmed COVID-19 patient or had a travel history to a COVID-19-affected country or city (10). The disease was diagnosed considering the clinical features, chest exam, laboratory findings, and reverse-transcription polymerase chain reaction (RT-PCR) test by the use of both throat and nose swab samples (11).

The diagnosis of the patients was carried out clinically via lung radiographical characteristics and also verified according to the laboratory-based data, i.e. RT-PCR by throat and nose swab samples from the upper respiratory tract, a test that accurately explains the characteristics of the diagnostic kit. The extraction of total RNA and also RT-PCR for coronavirus genes were performed using High Pure RNA Isolation Kit (Roche Diagnostics, Penzberg, Germany) and Taqman® Premix (TaKaRa, Dalian, China), respectively, according to the protocol recommended by manufacturer.

Laboratory assessment

Peripheral venous blood samples were collected on admission or during the hospital stay. Red and white blood cell count, leukocyte subtypes count, blood type, hematocrit count, hemoglobin count, and platelet count were the routine blood tests carried out by using an automated hematology analyzer (Sysmex Corporation, Kobe, Japan). Platelet, lymphocyte, and neutrophil counts, serum urea and creatinine, C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), aspartate aminotransferase (AST), alanine aminotransferase (ALT), albumin level, lactate dehydrogenase (LDH), and so on were other laboratory data.

CT image acquisition

Radiological evaluations were made according to CT images. Two expert radiologists assessed the presence of any radiological deformity based on the evidence or description in the medical records and finally rechecked the results. The significant CT imaging findings in each lobe, three lobes in the right lung

and two lobes in the left lung, were scored. Scores of 1 and 2 were given to the alterations in Ground-glass opacities (including crazy paving) of <3 cm and >3 cm, respectively. Also, CT score of 0 was defined as normal, while those of 1-7 and 8-15 were interpreted as less than severe and severe, respectively.

Statistical analysis

The analysis of the data were conducted by the aid of descriptive statistics (e.g. mean, frequency tables, standard deviation, and variance) and also by analytical tests (e.g. Chi-square, Pierson correlation coefficient test, and ANOVA), using SPSS version 27. The probability level of less than 0.5 was considered to be statistically significant (p <0.05).

Results

Presenting characteristics

The study population included 2204 patients with COVID-19 whose laboratory tests were confirmed. The mean age of patients was 56.67% who had an age range of 3-100 years. Among the patients included in this study, 451 were under the age of 40, of whom 8 died (1.8%), and 1747 were over the age of 40, of whom 94 died (5.4%). There was a significant difference between age and mortality rate. Among the patients, 1209 (54.85%) were male and 995 (45.14%) were female. In this study, 23.1% of patients were admitted to the ICU, and 3.2% of patients were rehospitalized. Among the hospitalized patients, 95.4% O_2 demanded.

Clinical signs and symptoms

The most common symptoms were pneumonia (96.8%), dyspnea (87.7%), and cough (75.4%) (Table I). Among COVID-19 comorbidities, there was a significant difference between death and the presence of chronic obstructive pulmonary disease (COPD) and cancer with p=0.015 and p =0.012, respectively. Various symptoms were reported at the onset of the disease. Among them, symptoms such as acute respiratory distress syndrome (ARDS) (p = 0.001), joint ache (p = 0.050), cough (p = 0.010), malaise (p = 0.001), nausea (p = 0.007), vomiting (p = 0.027), and myalgia (p = 0.001) were significantly different between the survivor and deceased groups.

Laboratory findings

According to the observations, blood creatinine levels have increased in deceased group compared to the survivors, which based on statistical analysis is a significant. In deceased patients, white blood cell (WBC) (p = 0.001) and absolutely neutrophil count (p = 0.001) increased and absolutely lymphocyte count (p = 0.001) decreased. Calcium and sodium levels were decreasing and increasing in the deceased group, respectively. Although no significant correlation was reported with calcium depletion, this correlation was significant for sodium increment. Alkaline phosphatase (ALP), albumin, carbon dioxide and ferritin decreased and bilirubin, aspartate aminotransferase (AST), blood urea nitrogen (BUN),

glucose, Lactate dehydrogenase (LDH), alanine aminotransferase (ALT) and Creatine Phosphokinase (CPK) increased in the deceased group but no significant correlation was observed. There was a significant increase in erythrocyte sedimentation rate (ESR) in the deceased group with p = 0.001. Although C-reactive protein (CRP) was increased in the deceased group, there was no significant difference between CRP and mortality rates. Information on laboratory findings is available in Table II.

Radiological findings

The results of CT scan and radiographs of patients' lungs showed different patterns. The most common abnormality was multiple mottling and ground glass opacity (964: 43.7%), followed by bilateral pneumonia (799: 36.3%). No cases of cavitation were observed. There were significant correlations between bilateral pneumonia, multiple mottling and ground glass opacity, bilateral patch**y** shadowing, and pleural effusion with death. There was a significant difference between the number of lung lobes involved in the disease and the incidence of death.

Interventions

According to Iranian treatment protocols, two groups of drugs were used to treat COVID-19(12). The first group included Oseltamivir, Hydroxychloroquine, Ribavirin and lopinavir/ritonavir and the second group included Recigen, Zifron, Vit D and Remdesivir (Table III). Among the various drug regimens, the most common was the combination of Oseltamivir, Hydroxychloroquine, and lopinavir/ritonavir (45.5%). There was a significant difference between survivor and deceased groups receiving plasma therapy (p = 0.049). During treatment, 96.1% of patients needed oxygen so they were intubated or used mechanical intubation. There was a significant difference between the two groups in both intubation (p = 0.001) and mechanical intubation (p = 0.001) methods (Table III).

Outcomes

The mortality rate among patients was 14%, of which 4.6% of deaths were due to COVID-19. Most causes of death for reasons other than COVID-19 included diabetes, high blood pressure, heart attack, and heart failure. The results showed that history of contact with suspected cases (p = 0.001) and history of contact with dyspnea cases had significant difference (p = 0.001). Patients with a history of contact with suspected and dyspnea cases had a higher mortality rate. The average number of admission days in ICU in the survivor and deceased groups was 4.79 (±5.292) and 6.43 (±5.961), respectively.

There was a significant difference between the number of hospitalization days and death (p = 0.024). Among the patients studied in this study, 1864 (96.6%) were discharged from the hospital. Analyzes showed that there was a significant difference and an inverse correlation between partial recovery with death rate in patients. Patients who had a history of visits medical centers two weeks before hospitalization were more likely to die than those without a history, which showed a significant difference (p = 0.001). Also, the analyses showed a significant correlation between the history of visiting medical centers and the rate of mortality.

Discussion

This retrospective study reports the demographics, clinical symptoms, and the results of laboratory tests findings of 2204 patients with confirmed COVID-19 infected, who were treated at Shahid Mostafa Khomeini Hospital, (Ilam, Iran).

Although the number of infected men was more than women, this difference was not significant. In a meta-analysis study, Hannah Packham et al reported that there was no difference in the proportion of men and women with COVID-19 (13). However, George M. Bwire reported that biological and lifestyle differences have led to reports in various studies that men are more likely to be infected than women. Of course, women are more likely than men to take preventive measures, such as the use of face masks and frequent hand washing (14).

The average age of the patients was 56.67 years but most deaths occur at an average age of 64.16 years. Previous studies reported a broadly similar age distribution (15-17). Mortality was significantly higher in people over 40 years of age, which is almost in the age range reported by the study of M. Nikpouraghdam et al in Iran (18). Based on these results, old age can be considered as a risk factor for death.

The frequency of blood groups $A^+/-$, $O^+/-$, $B^+/-$ and $AB^+/-$ among patients was estimated as 40.5/1.4%, 29.1/3.7%, 16.3/1.4% and 6.5/0.6% respectively. The frequency of blood groups $A^+/-$, $O^+/-$, $B^+/-$ and $AB^+/-$ among individuals who died of this infection was estimated as 48.4/3.2%, 29.3/3.2%, 9.7/1.6% and 8.1/0.0% respectively. This study confirmed the relationship between ABO blood groups and COVID-19 sensitivity in patients. Patients with blood type A had a higher frequency compared to non-blood type A and patients with blood type AB had a much lower frequency compared to non-blood type AB.

In the meta-analysis performed by Liu, blood groups A and B were significantly more at risk for COVID-19, whereas this was not the case for blood group AB, people with blood type O were not susceptible to the disease (19). The researchers found that in people with blood type O, the production of natural anti-A and anti-B antibodies could potentially prevent viral attachment to host cells, a mechanism that could explain their lower risk of infection compared to other blood groups (20).

However, in this study, blood group O along with blood group A are more common among patients, which may be due to the fact that blood group O (36.49%) and A (32.09%) are the most blood common group among Iranians (21).

The most common symptoms in patients referred to the hospital were pneumonia (96.8%), dyspnea (87.7%); cough (75.4%); myalgia (54.2%); fever (53.6%); and shiver (48.7%). Other symptoms at illness onset were malaise (35%); nausea (29.5%); vomiting (22.7%); headache (25.7%). The proportion of patients who developed dyspnea in our analysis (87.7%) was more than that reported from meta-analysis done in China and other countries, where over 33.9% of the patients examined had dyspnea (22). As stated in other studies on the clinical signs of COVID-19, few patients had prominent upper respiratory

tract signs and symptoms (runny nose (5.9%) or sore throat (19.5%)), indicating that the target cells might be located in the lower airway, furthermore, COVID-19patients rarely developed gastrointestinal signs and symptoms (diarrhea (8.8%), eg) (8).

In this study, patients with severe illness developed ARDS (7.9%), required ICU admission (23.1%), intubation (13.7%), mechanical intubation (13.7) and oxygen therapy (96.1%). Among those who died, 99% needed oxygen, 89% needed incubation, and 71% needed mechanical incubation. The need for invasive mechanical ventilation in this patient population was less than that in Italy (88%) (23), but it was more than China (47% and 42%) (24, 25), and equal to Washington State (71%) (26). The mortality rate in patients who required ICU and mechanical intubation was statistically significantly higher than patients who did not require ICU and mechanical intubation.

According to our results, a total of 54.7% of patients had at least one underling disease in line with that reported by Grasselli (68%)(23) and Wang et al (72.2%)(24): HTN (31.2%), diabetes (22.8%), heart disease (21.9). As with other studies (18, 27), our results it also showed that having co-morbidities can have a statistically significant effect on mortality. Compared to the two groups, only the presence of cancer and COPD was statistically significant.

Based on our data, most abnormal radiologic findings consisted of bilateral pneumonia, multiple mottling and ground-glass opacity, bilateral patchy shadowing, and pleural effusion. As with other publications, our data show that CT scans can play an important role in diagnosing and assessing the severity of the disease (28). Many studies have referred to bilateral pneumonia and bilateral ground-glass opacities on CT scans of people with COVID-19, which have also been seen in our study (24, 29, 30). These symptoms were more common in the deceased patients than in the survivors.

Among laboratory findings, WBC, absolute neutrophil count, Na+, BUN and ESR were higher among in the deceased patients in comparison to the survivors, and the results are in accordance with the previous studies (31). According to the results of a meta-analysis study, patients with Covid-19 with lymphopenia are more likely to develop severe disease (32). In the present study, the number of lymphocytes decreased in people who died compared to those who survived. Contact with infected people has played an important role in the spread of the disease, according to past studies (33, 34).

In this study, the history of occupational contact, contact with suspected cases and referral to medical centers during the two weeks before hospitalization were significantly higher in people who died than in other patients. In Brazil, a total of 34.4% patients had a recent international travel history and 61.1% patients had a history of close contact either with a positive or suspected case of COVID-19 (35). In the study of Xi-Min Qiao et al 53.33% of patients had the history of travel to Wuhan, 26.67% of patients had close contact with confirmed patients, and 6.67% of patient had close contact with suspected patients (36).

In the study of Nopsopon T et al no participants with a history of travel to the high-risk area or close contact with PCR-confirmed COVID-19 case developed SARS-CoV-2 antibodies. No association between

history of travel to a high-risk area and close contact with PCR-confirmed or suspected COVID-19 case, was found (37).

Some people believe that alcohol consumption is beneficial for the prevention and treatment of COVID-19 (38). Among patients, 11 (0.5%) patients consumed alcohol and 82 (3.70%) were current smokers; also 41 (1.9%) patients were addicted. No relationship was found between severity of COVID-19 and smoking, and drinking alcohol in this study. The prevalence of low alcohol consumption in our study is probably due to the fact that in Iran, like many Muslim majority countries where alcohol consumption is prohibited (39). Mengyuan Dai's findings indicated that COVID-19 patients with a history of cigarette smoking tend to have more severe outcomes than non-smoking patients. However, alcohol consumption did not reveal significant effects on neither development of severe illness nor death rates in COVID-19 patients (40). In the study of Jin-jin Zhang et al, current smokers (1.4%) were rare (41).

In the study of Suman Saurabh et al, alcohol use was found to increase the risk of symptomatic disease as compared with asymptomatic infection. Current tobacco smoking but not smokeless tobacco use appeared to reduce the risk of symptomatic disease (42). The smoking and drinking chewing rates in Rui Zhong's study were 15.4 and 26.4%, respectively. The chi-square test showed no statistical significance with the classification of COVID-19. The smoking rate of COVID-19 patients was lower than that the general population (43). The studies of Zhang J. J. et al, 2020 in China on COVID-19 and smoking showed that only 12.6% of patients were smokers, Which was more than the smoking rate in our study (2.8%) (43).

Two groups of drugs were used to manage COVID-19 based on Iranian treatment protocols and disease severity in individual (12). Group one included Oseltamivir, Hydroxychloroquine, Ribavirin and lopinavir/ritonavir. There was no significant difference between the group of survivors and the deceased patients used this drug group. A clinical trial was conducted in United Kingdom, to investigate various drug candidates or therapies including Hydroxychloroquine against severe COVID-19 (44). The result demonstrated no efficacy of Hydroxychloroquine against COVID-19 (44). In this study, there was no significant difference between the group of survivors and the deceased patients used Hydroxychloroquine and Oseltamivir. But in the second group, which included Recigen and Zifron as interferon-β1b, Vit D and Remdesivir, there was a significant difference between the survivors and the deceased patients.

Getu Zhaori et al, found that among the reports on monotherapies, only remdesivir, and among combined antiviral agents, only the combined regimen with interferon-β1b, lopinavir-ritonavir and ribavirin were effective and safe based on evidences from RCTs (45). In the study of Pan H et al, remdesivir, Hydroxychloroquine, lopinavir, and interferon regimens had little or no effect on hospitalized patients with COVID-19, as indicated by overall mortality, initiation of ventilation, and duration of hospital stay (46).

Data from John H. Beigel et al show that Remdesivir was superior to placebo in shortening the time to recovery in adults who were hospitalized with Covid-19 and had evidence of lower respiratory tract infection (47). Hensley et al reported that IFN-β-1a could be an effective therapeutic agent for SARS-CoV

infections. In that study, IFN-β-1a demonstrated potent antiviral activity and acceptable safety profiles, suggesting its efficacy in coronavirus treatment (48). The results of the Pooya P et al study are also in favor of using Interferon beta-1a in addition to recommended antiviral treatment in COVID-19 patients (49).

These data suggest that mortality was associated with older age, multiple co-morbidities, abnormal CT scans at admission, direct admission to the ICU, low lymphocyte count, history of suspected exposure, and intubation. Also, drugs including interferon beta (Recigen or Zifron) and Remdesivir are also effective in reducing mortality.

Conclusion

According to the results of the current study, it can be concluded mortality was associated with older age, multiple co-morbidities, abnormal CT scans at admission, direct admission to the ICU, low lymphocyte count, history of suspected exposure, and intubation. In fact, it seems that COVID-19 patients in west of Iran have a special profile of disease. Identifying the characteristics of the disease would translate into the implementation of practical measures to improve results.

Abbreviations

COVID-19: Coronavirus disease-2019

SARS-CoV2: Severe acute respiratory syndrome coronavirus 2

WHO: World Health Organization

ARDS: Acute respiratory distress syndrome

RT-PCR: Reverse-transcription polymerase chain reaction

CRP: C-reactive protein

ESR: Erythrocyte sedimentation rate

AST: Aspartate aminotransferase

ALT: Alanine aminotransferase

LDH: Lactate dehydrogenase

Declarations

Availability of data and material

All the data in this research are included in the manuscript.

Authors' contribution

Mohammad Reza Kaffashian, Maryam Shirani, Maryam Koupaei, Nourkhoda Sadeghifard, Iraj Ahmadi, Ali Ashraf Mozafari, Ali Nazari, Mohsen Heidary, and Saeed Khoshnood contributed in revising and final approval of the version to be published. All authors agreed and confirmed the manuscript for publication.

Conflict of interest

Authors declare that they have no competing interests.

Ethical approval

Not applicable.

Informed consent

Not applicable.

Funding

Not applicable.

Consent for publication

Not applicable.

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Tables

Table I. Clinical, radiological, and comorbidities features of patients with COVID-19.

Variable		Total (%)	Death (%)	Live (%)	p-value
General features					
Age (year)	≤40	451 (20.5)	8 (1.8)	443 (98.2)	0.001
	>40	1747 (79.5)	94 (5.4)	1653 (94.6)	
Sex	Female	995 (45.14)	40 (39.2)	953 (45.4)	0.219
	Male	1209 (54.85)	62 (60.8)	1145 (54.6)	
Marital status	Married	2101 (95.5)	98 (97.0)	2003 (95.4)	0.624
	Single	100 (4.5)	3 (3.0)	97 (4.6)	
PCR	Negative	67 (3.0)	2 (2.0)	65 (3.1)	0.051
	Positive	2115 (96.0)	96 (94.1)	2019 (96.1)	
	Not defined	22 (1.0)	18 (0.9)	4 (3.9)	
BG	O+	406 (29.1)	16 (29.3)	390 (29.3)	0.668
	A+	564 (40.5)	30 (48.4)	534 (40.1)	
	B+	227 (16.3)	6 (9.7)	221 (16.6)	
	AB+	91 (6.5)	5 (8.1)	86 (6.5)	
	A-	25 (1.8)	2 (3.2)	23 (1.7)	
	B-	20 (1.4)	1 (1.6)	19 (1.4)	
	AB-	9 (0.6)	0 (0.0)	9 (0.7)	
	O-	52 (3.7)	2 (3.2)	50 (3.8)	

Symptoms					
ARDS	No	2029 (92.1)	74 (72.5)	1955 (93.0)	0.001
	Yes	175 (7.9)	28 (27.5)	147 (7.0)	
Joint-ache	No	2090 (94.8)	101 (99.0)	1989 (94.6)	0.050
	Yes	114 (5.2)	1 (1.0)	113 (5.4)	
Cough	No	542 (24.6)	36 (35.3)	506 (24.1)	0.010
	Yes	1662 (75.4)	66 (64.7)	1596 (75.9)	
Conjunctivitis	No	2196 (99.6)	102 (100.0)	2094 (99.6)	1.000
	Yes	8 (0.4)	0 (0.0)	8 (0.4)	
Malaise	No	1433 (65.0)	49 (48.5)	1384 (65.8)	0.001
	Yes	770 (35.0)	52 (51.9)	718 (34.2)	
Nausea	No	1553 (70.5)	84 (82.4)	1469 (69.9)	0.007
	Yes	651 (29.5)	18 (17.6)	633 (30.1)	
Vomiting	No	1702 (77.3)	88 (86.3)	1614 (76.9)	0.027
	Yes	499 (22.7)	14 (13.7)	485 (23.1)	
Headache	No	1638 (74.3)	80 (78.4)	1558 (74.1)	0.330
	Yes	566 (25.7)	22 (21.6)	544 (25.9)	
Myalgia	No	1007 (45.8)	64 (62.7)	943 (44.9)	0.001
	Yes	1194 (54.2)	38 (37.3)	1156 (55.1)	
Shiver	No	1130 (51.3)	61 (59.8)	1069 (50.9)	0.077

	Yes	1074 (48.7)	41 (40.2)	1033 (49.1)	
Fever	No	1022 (46.4)	50 (49.0)	972 (46.2)	0.583
	Yes	1182 (53.6)	52 (51.0)	1130 (53.8)	
Diarrhea	No	2011 (91.2)	95 (93.1)	1916 (91.2)	0.488
	Yes	193 (8.8)	7 (6.9)	186 (8.8)	
Pneumonia	No	60 (3.2)	5 (5.3)	55 (3.1)	0.226
	Yes	1818 (96.8)	90 (94.7)	1728 (96.9)	
Runny nose	No	2074 (94.1)	99 (97.1)	1975 (94.0)	0.194
	Yes	130 (5.9)	3 (2.9)	127 (6.0)	
Sore throat	No	1775 (80.5)	87 (85.3)	1688 (80.3)	0.214
	Yes	429 (19.5)	15 (14.7)	414 (19.7)	
Dyspnea	No	272 (12.3)	9 (8.8)	263 (12.5)	0.206
	Yes	1932 (87.7)	93 (91.2)	1839 (87.5)	
Loss smell	No	1869 (85.9)	81 (87.1)	1788 (85.8)	0.733
	Yes	307 (14.1)	12 (12.9)	295 (14.2)	
Loss taste	No	1872 (86.0)	79 (86.8)	1793 (86.0)	0.817
	Yes	305 (14.0)	12 (13.2)	293 (14.0)	
ICU admission	No	1695 (76.9)	23 (22.5)	1672 (79.5)	0.001
	Yes	509 (23.1)	79 (77.5)	430 (20.5)	
O_2 demand	No	86 (3.9)	1 (1.0)	85 (4.1)	0.082

	Yes	2102 (96.1)	101 (99.0)	2001 (95.9)	
Discharge from the hospital	No	66 (3.4)	31 (91.2)	35 (1.8)	0.001
	Yes	1864 (96.6)	3 (8.8)	1861 (98.2)	
Comorbidities					
Underlying disease	No	998 (45.3)	60 (60.0)	938 (44.6)	0.003
	Yes	1203 (54.7)	40 (40.0)	1163 (55.4)	
CABG	No	2137 (97.0)	98 (96.1)	2039 (97.0)	0.549
	Yes	67 (3.0)	4 (3.9)	63 (3.0)	
Thyroid disorders	No	2152 (97.6)	102 (100)	2050 (97.5)	0.083
	Hypothyroid	46 (2.1)	0 (0.0)	46 (2.2)	
	Hyperthyroid	6 (0.3)	0 (0.0)	6 (0.3)	
Heart disease	No	1717 (78.1)	77 (75.5)	1640 (78.2)	0.517
	Yes	482 (21.9)	25 (24.5)	457 (21.8)	
HTN	No	1515 (68.8)	72 (70.6)	1443 (63.7)	0.517
	Yes	686 (31.2)	30 (29.4)	656 (31.3)	
COPD	No	2084 (94.6)	91 (89.2)	1993 (94.8)	0.015
	Yes	120 (5.4)	11 (10.8)	109 (5.2)	
Diabetes	No	1701 (77.2)	76 (75.2)	1625 (77.3)	0.623
	Yes	501 (22.8)	25 (24.8)	476 (22.7)	

Dialysis	No	2143 (97.2)	98 (96.1)	2045 (97.3)	0.527
	Yes	61 (2.8)	4 (3.9)	57 (2.7)	
Dialysis year	0	1 (2.0)	0 (0.0)	1 (2.1)	0.990
	1	11 (22.4)	1 (50.0)	10 (21.3)	
	2	9 (18.4)	0 (0.0)	9 (19.1)	
	3	20 (40.8)	1 (50.0)	19 (40.4)	
	4	3 (6.1)	0 (0.0)	3 (6.4)	
	6	1 (2.0)	0 (0.0)	1 (2.1)	
	7	1 (2.0)	0 (0.0)	1 (2.1)	
	8	1 (2.0)	0 (0.0)	1 (2.1)	
	10	1 (2.0)	0 (0.0)	1 (2.1)	
	12	1 (2.0)	0 (0.0)		
Hemoglobinopathy	No	2197 (99.7)	102 (100.0)	2095 (99.7)	1.000
	Yes	7 (0.3)	0 (0.0)	7 (0.3)	
Immunodeficiency	No	2143 (97.3)	99 (97.1)	2044 (97.3)	0.756
	Yes	60 (2.7)	3 (2.9)	57 (2.7)	
Liver disease	No	2182 (99.0)	102 (99.1)	2081 (99.0)	1.000
	Yes	22 (1.0)	1 (1.0)	21 (1.0)	
Metabolic disease	No	2134 (96.9)	101 (99.1)	2033 (96.8)	0.373
	Yes	69 (3.1)	1 (1.0)	68 (3.2)	
Psycho disease	No	2159 (98.0)	100 (99.0)	2059 (98.0)	0.720
	Yes	44 (2.0)	1 (1.0)	43 (2.0)	
Neurologic disease	No	2104	97	2007	0.805

	Yes	(95.5) 99 (4.5)	(95.1) 5 (4.9)	(95.5) 94 (4.5)	
Kidney disease	No Yes	2104 (95.5) 100 (4.5)	95 (93.1) 7 (6.9)	2009 (95.6) 93 (4.4)	0.224
Cancer	No Yes	2149 (97.5) 55 (2.5)	95 (93.1) 7 (6.9)	2054 (97.7) 48 (2.3)	0.012
Addiction 1	No Yes	2163 (98.1) 41 (1.9)	100 (98.0) 2 (2.0)	2063 (98.1) 39 (1.9)	0.715
Pregnancy	No Yes	2191 (99.4) 13 (0.6)	102 (100.0) 0 (0.0)	2089 (99.4) 13 (0.6)	1.000
Smoking	No Ex-smoke Smoke	2122 (96.0) 20 (0.9) 62 (2.8)	95 (93.1) 2 (2.0) 5 (4.9)	2027 (96.4) 18 (0.9) 57 (2.7)	0.290
Smoke number in a day	2 3 5 10 15 20	1 (2.1) 3 (6.4) 1 (2.1) 26 (55.3) 3 (6.4) 13 (27.7)	0 (0.0) 0 (0.0) 0 (0.0) 3 (75.0) 0 (0.0) 1 (25.0)	1 (2.3) 3 (7.0) 1 (2.3) 23 (53.5) 3 (7.0) 12 (27.9)	0.887
Smoke year	3 5 8 10	1 (2.8) 3 (8.3) 1 (2.8) 11 (30.6)	0 (0.0) 0 (0.0) 0 (0.0) 0 (0.0)	1 (2.9) 3 (8.8) 1 (2.9) 11 (32.4)	0.856

	15	4 (11.1)	0 (0.0)	4 (11.8)	
	20	8 (22.2)	1 (50.1)	7 (20.6)	
	25	6 (16.7)	1 (50.1)	5 (14.7)	
	30	1 (2.8)	0 (0.0)	1 (2.9)	
	36	1 (2.8)	0 (0.0)	1 (2.9)	
Alcohol	No	2193 (99.50	102 (100.0)	2091 (99.5)	1.000
	Yes	11 (0.5)	0 (0.0)	11 (0.5)	
Job catches infect	No	267 (12.1)	30 (29.4)	237 (11.3)	0.001
	Unknown	785 (35.6)	48 (47.1)	737 (35.1)	
	Yes	31 (1.4)	1 (1.0)	302 (1.4)	
History of contact with dyspnea cases	No	21 (1.6)	5 (4.9)	16 (0.8)	0.001
	Unknown	1303 (59.1)	75 (73.5)	1228 (58.4)	
	Yes	786 (35.7)	19 (18.6)	767 (36.5)	
History of contact with suspected cases	No	23 (1.0)	7 (6.9)	16 (0.8)	0.001
	Unknown	1355 (61.5)	77 (75.5)	1278 (60.8)	
	Yes	742 (33.7)	16 (15.7)	726 (34.5)	
History of visit medical centers two weeks before hospitalization	No	640 (54.8)	44 (6.9)	596 (93.1)	0.001
	Unknown	1208 (29.0)	29 (2.4)	1179 (97.6)	
	Yes	356 (16.2)	29 (8.1)	327 (91.9)	
Previous Corticosteroid Therapy	No	2149 (97.5)	99 (97.1)	2050 (97.5)	0.740
	Yes	55 (2.5)	3 (2.9)	52 (2.5)	

Radiological features					
Bilateral pneumonia	No	1405 (63.7)	46 (3.3)	1359 (96.7)	0.001
	Yes	799 (36.3)	56 (54.9)	743 (93.0)	
Unilateral pneumonia	No	2201 (99.9)	102 (4.6)	2099 (95.4)	1.000
	Yes	3 (0.1)	0 (0.0)	3 (100.0)	
Multiple mottling and ground glass opacity	No	1240 (56.3)	42 (3.4)	1198 (96.6)	0.002
	Yes	964 (43.7)	60 (6.2)	904 (6.2)	
Pneumothorax	No	2203 (100.0)	102 (4.6)	2101 (95.4)	1.000
	Yes	1 (0.0)	0 (0.0)	1 (100.0)	
Local patchy shadowing	No	2202 (99.9)	102 (4.6)	2100 (95.4)	1.000
	Yes	2 (0.1)	0 (0.0)	2 (100.0)	
Bilateral patchy shadowing	No	2052 (93.1)	88 (4.3)	1964 (95.7)	0.014
	Yes	152 (6.9)	14 (9.2)	138 (90.8)	
Interstitial abnormalities	No	2200 (99.8)	101 (4.6)	2099 (95.4)	0.173
	Yes	4 (0.2)	1 (25.0)	3 (75.0)	
Consolidation	No	1995 (90.5)	88 (4.4)	1907 (95.6)	0.163
	Yes	209 (9.5)	14 (6.7)	195 (93.3)	
Crazy paving	No	2178 (98.8)	99 (4.5)	2079 (95.5)	0.116
	Yes	26 (1.2)	3 (11.5)	23 (88.5)	
Linear	No	2203 (100.0)	102 (4.6)	2101 (95.4)	1.000
	Yes	1 (0.0)	0 (0.0)	1 (100.0)	

Discrete nodules	No	2202 (99.9)	102 (4.6)	2100 (95.4)	1.000
	Yes	2 (0.1)	0 (0.0)	2 (100.0)	
Pleural effusion	No	2134 (96.8)	93 (4.4)	2041 (95.6)	0.004
	Yes	70 (3.2)	9 (12.9)	61 (87.1)	
Lymphadenopathy	No	2202 (99.9)	102 (4.6)	2100 (95.4)	1.000
	Yes	2 (0.1)	0 (0.0)	2 (100.0)	
Peripheral distribution	No	2020 (91.7)	96 (4.8)	1924 (95.2)	0.463
	Yes	184 (8.3)	6 (3.3)	178 (96.7)	
Lung lobe affect	1	6 (0.6)	0 (0.0)	6 (0.6)	0.001
	2	65 (6.3)	0 (0.0)	65 (6.7)	
	3	404 (39.2)	3 (4.5)	401 (41.6)	
	4	364 (35.3)	28 (42.4)	336 (34.8)	
	5	192 (18.6)	35 (53.0)	157 (16.3)	

Table II. Laboratory features of patients with COVID-19.

Findings (±SD) (n= 2204)	Mean Total	Mean (±SD)		p-value
		Death (n= 308)	Live (n= 1896)	
Age	56.67 (±17.164)	64.16 (±16.308)	56.30 (±17.125)	0.001
HGT	168.7068 (±9.70889)	168.4045 (±7.49957)	168.7221 (±9.80866)	0.702
WGT	76.4627 (±13.65914)	75.2921 (±13.91713)	76.5219 (±13.64733)	0.407
BMI	27.0762 (±11.31538)	26.5361 (±4.59819)	27.1035 (±11.55188)	0.645
Total protein	6.16 (±1.458)	5.80 (±0.458)	6.20 (±1.535)	0.662
Creatinine (mg/dL)	1.37 (±1.523)	1.79 (±1.375)	1.35 (±1.527)	0.003
Creatinine after threat	3.1000 (±2.00448)	5.0250 (±2.69614)	2.8038 (±1.76193)	0.003
Red cell count	8.35 (±161.412)	9.32 (±48.043)	8.30 (±164.867)	0.951
WBC	8618.79 (±9279.467)	12082.83 (±7360.679)	8453.44 (±9330.544)	0.001
WBC after threat	12922.222 (±7486.7847)	20000.000	12037.500 (±7483.8755)	0.349
Hematocrit (%)	39.78 (±6.267)	39.10 (±6.845)	39.82 (±6.238)	0.265
Hemoglobin (g/L)	13.43 (±2.347)	13.06 (±2.260)	13.45 (±2.350)	0.112
PLT	212928.82 (±98103.822)	208846.94 (±82438.650)	213122.72 (±98799.001)	0.673
Platelet after threat	207173.913 (±149069.4323)	38000.000	214863.636 (±147834.6230)	0.255
Absolute lymphocyte count	22.52 (±11.184)	17.40 (±11.913)	22.77 (±11.092)	0.001
Absolute neutrophil count	75.81 (±11.932)	81.60 (±12.642)	75.54 (±11.830)	0.001
Carbon dioxide	52.26 (±39.830)	45.27 (±21.863)	53.39 (±41.954)	0.356
Calcium	14.91 (±231.746)	10.31 (±9.171)	15.13 (±237.241)	0.844
Phosphorus	3.46 (±0.690)	3.77 (±1.576)	3.45 (±0.621)	0.155
Magnesium	2.16 (±0.524)	2.21 (±0.399)	2.16 (±0.529)	0.428
Sodium (mmol/L)	137.92 (±6.623)	139.42 (±4.595)	137.85 (±6.695)	0.024

Potassium (mmol/L)	4.15 (±4.442)	4.55 (±3.804)	4.13 (±4.469)	0.380
Potassium after threat	4.0167 (±1.12679)	3.6000	4.1000 (±1.23895)	0.731
BUN (mg/dL)	41.91 (±33.351)	64.27 (±49.968)	40.84 (±31.971)	0.001
Bun after threat	132.4615 (±66.65035)	213.5000 (±38.89087)	117.7273 (±60.22639)	0.057
Total bilirubin (mmol/L)	1.00 (±5.203)	117.7273 (±60.22639)	0.91 (±4.801)	0.084
AST (U/L)	52.09 (±96.446)	67.91 (±93.271)	51.38 (±96.550)	0.136
ALT (U/L)	42.61 (±71.838)	54.54 (±79.754)	42.10 (±71.457)	0.142
Albumin (g/L)	5.42 (±34.010)	3.74 (±0.700)	5.51 (±34.898)	0.697
Glucose	145.31 (±92.129)	159.36 (±97.256)	144.66 (±91.860)	0.146
LDH (U/L)	781.09 (±6637.455)	907.39 (±887.942)	774.93 (±6794.664)	0.865
CPK	235.10 (±475.114)	416.00 (±1224.209)	223.35 (±377.245)	0.233
PTT	29.79 (±10.078)	30.74 (±11.425)	29.74 (±10.013)	0.373
PT	12.81 (±5.508)	13.51 (±3.024)	12.78 (±5.593)	0.234
ALP	412.42 (±7488.511)	283.27 (±336.367)	418.14 (±7652.042)	0.885
CRP (mg/L)	1.83 (±1.210)	1.73 (±1.187)	1.83 (±1.211)	0.470
Ferritin	39.09 (±326.232)	1.97 (±0.912)	42.49 (±340.797)	0.709
ESR (mm/h)	37.84 (±28.461)	48.27 (±30.392)	37.38 (±28.292)	0.001
D-dimer	0.2037 (±0.30444)	0.3462 (±0.32046)	0.1986 (±0.30309)	0.086
Troponin	0.03 (±0.165)	0.07 (±0.254)	0.03 (±0.160)	0.098
Fever degree	37.98 (±1.186)	37.28 (±5.212)	38.01 (±0.491)	0.363

Table III. Medication regimens and treatments used in patients with COVID-19.

Medication regimens and treatments		Total (%)	Death (%)	Live (%)	p-value
Oseltamivir + Hydroxychloroquine	No	2111 (95.8)	96 (94.1)	2015 (95.9)	0.442
	Yes	93 (4.2)	6 (5.9)	87 (4.1)	
Oseltamivir + Hydroxychloroquine + lopinavir/ritonavir	No	1202 (54.5)	65 (63.7)	1137 (54.1)	0.056
	Yes	1002 (45.5)	37 (36.3)	965 (45.9)	
Oseltamivir + Hydroxychloroquine + lopinavir/ritonavir + Ribavirin	No	2198 (99.7)	101 (99.0)	2097 (99.8)	0.248
	Yes	6 (0.3)	1 (1.0)	5 (0.2)	
Oseltamivir + Hydroxychloroquine		88 (4.0)	6 (5.9)	82 (3.9)	0.209
Oseltamivir + Hydroxychloroquine + lopinavir/ritonavir		1007 (45.7)	38 (37.3)	969 (46.1)	
Oseltamivir + Hydroxychloroquine + lopinavir/ritonavir + Ribavirin		6 (0.3)	1 (1.0)	5 (0.2)	
None		1102 (50.0)	57 (55.9)	1045 (49.7)	
Recigen or Zifron	No	2177 (98.8)	102 (100.0)	2075 (98.7)	0.634
	Yes	27 (1.2)	0 (0.0)	27 (1.0)	
Recigen + Vitamin D	No	2095 (95.1)	101 (99.0)	1994 (94.9)	0.059
	Yes	109 (4.9)	1 (1.0)	108 (5.1)	
Recigen + Vitamin D + Remdesivir	No	1945 (88.2)	95 (93.1)	1850 (88.0)	0.116
	Yes	259 (11.8)	7 (6.9)	252 (12.0)	
Recigen or Zifron		26 (1.2)	0 (0.0)	26 (1.2)	0.009
Recigen + Zifron + Vit D		103 (4.7)	1 (1.0)	102 (4.9)	
Recigen + Zifron + Vit D + Remdesivir			7 (6.9)		

Non		275 (12.5) 1800 (81.7)	94 (92.2)	268 (12.7) 1706 (81.2)	
Plasma Therapy	No Yes	2146 (97.4) 58 (2.6)	96 (94.1) 6 (5.9)	2050 (97.5) 52 (2.5)	0.049
Intubation	No Yes	1901 (86.3) 303 (13.7)	13 (12.7) 89 (87.3)	1888 (89.8) 214 (10.2)	0.001
Mechanical intubation	No Yes	1940 (88.0) 264 (12.0)	29 (28.4) 73 (71.6)	1911 (90.9) 191 (9.1)	0.001