Analysis of the effects of clinical features, initial imaging findings and the number of days that nucleic acids turned negative: 201 cases of COVID-19 patients

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Research

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Abstract

Background: COVID-19 had spread quickly among the population and it has caused considerable morbidity and mortality in more than 200 countries worldwide, which became a public health emergency of international concern. This study was to investigate whether some clinical features, laboratory tests and imaging findings at the initial diagnosis of COVID-19 infection affect the number of days that nucleic acids turned negative (D_{negative}) during hospitalization.

Methods: The Mann-Whitney U test and one-way analysis of variance (ANOVA) were used to examine the difference in D_{negative} between clinical features, laboratory tests and imaging findings. ANOVA was also applied to differentiate between the age, D_{negative} and imaging findings among different clinical types. Multiple linear regression (MLR) analysis was used to quantify the effect of clinical characteristics, imaging findings and D_{negative} and establish regression equation.

Results: The D_{negative} of COVID-19 patients who had comorbidity was significantly larger than that of those without (33.35 ± 14.63 , 27.79 ± 12.89 , $P = 0.007$). Common patients were younger than severe and critically severe patients ($P < 0.001$, $P = 0.003$). As compared to common patients, severe patients had larger D_{negative} ($P < 0.001$), and the ratio of ground-glass opacity (R_{GGO}), consolidation (R_{C}), and the sum of GGO and consolidation (R_{SUM}) of lesions on chest CT increased significantly (all $P < 0.001$). The MLR analysis equation was $y(D_{\text{negative}}) = 22.35 + 0.36 \times R_{\text{SUM}}$.

Conclusions: The severe COVID-19 patients were older than common patients, and their D_{negative} were larger as well. The chest CT findings at initial diagnosis (including R_{GGO} , R_{C} , and R_{SUM}) could be used to differentially diagnose the common and severe patients, and had certain potential ability in predicting D_{negative} .

Trial registration: Retrospectively registered.

Background

Since December 2019, several cases of pneumonia of unknown aetiology were diagnosed with severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) in Wuhan, China. Recently, the World Health Organization formally named it as novel coronavirus disease 2019 (COVID-19)[1, 2]. The virus spread quickly among the population as soon as it was discovered. To date, it has caused considerable morbidity and mortality in more than 200 countries worldwide [3], which became a public health emergency of international concern. As of April 19, 2020, more than 84,000 patients in China have been diagnosed with the virus, and the number of COVID-19 patients overseas has reached more than 2.27 million. However, the virus was still propagating at an alarming rate primarily through respiratory droplets and close contact.

COVID-19 was an enveloped RNA virus with diverse clinical manifestations but lack of features, which brought certain difficulties in clinical diagnosis[4]. It was mainly confirmed by nucleic acid testing of respiratory secretions or excreta of the digestive tract. Previous study [5] reported that, out of 1014 patients infected with COVID-19, only 59% had positive nucleic acid test, whilst the sensitivity of chest CT was as high as 97%. Therefore, laboratory test and imaging findings were often essential in clinic to assist diagnosis, which played an important role in early diagnosis of COVID-19 patients, especially those who were asymptomatic or had no obvious symptoms. At present, the etiology and pathogenesis of COVID-19 were still unclear, and there was no unified standard for the diagnosis and treatment and feasible method to evaluate the efficacy and prognosis of COVID-19 patients.

By retrospectively analyzing the nucleic acid results and imaging findings of 201 patients confirmed with COVID-19, we explored whether some clinical features, the initial laboratory tests and imaging findings would affect the number of days that nucleic acids turned negative (D_{negative}) during hospitalization, so as to provide some guidance for the clinical evaluation of the patient's condition and hospitalization time.

Methods

Patients

We retrospectively collected 229 hospitalized patients in our hospital from January to March, 2020, and screened them according to the following inclusion criteria: (1) They were confirmed COVID-19 by nucleic acid test of nasopharyngeal swab; (2) The nucleic acid test results during hospitalization can be tracked, especially before hospital discharge; (3) The patient's medical record was relatively complete, and the clinical information of can be obtained; (4) The patient's chest CT image was clear enough to identify the lesion and for subsequent statistical analysis. Finally, a total of 201 patients were involved in this study. The clinical features, the laboratory tests and chest CT examinations of all patients were recorded. The clinical information mainly included the gender, age, clinical symptoms at the time of onset, exposure history, and comorbidity, etc. The laboratory tests involved the white blood cells, lymphocytes, C-reactive protein, and albumin, etc. For chest CT findings, the lung combined other lesions, lesion distribution, the ground-glass opacity (GGO), consolidation, the sum of GGO and consolidation in the lung were included. In addition, we tracked all patient's nucleic acid tests during treatment (including before and during hospitalization), and counted the number of days between the patient's diagnosis of COVID-19 infection and the nucleic acid turning negative. Herein, the date of nucleic acid turning negative meant the date when the first nucleic acid test that met the discharge criteria in the clinic was negative.

According to the fifth edition of the China Guidelines for the Diagnosis and Treatment Plan of Novel Coronavirus (2019-nCoV) Infection by the National Health Commission (Trial Version 5)[6], all COVID-19 patients were divided into four types: (1) mild type: with slight clinical symptoms, but no pneumonia manifestations in imaging; (2) common type: has fever, respiratory symptoms and imaging manifestations of pneumonia; (3) severe type: meeting any of the following: respiratory distress with RR ≥ 30 times/min, oxygen saturation at rest $\leq 93\%$, or $\text{PaO}_2/\text{FiO}_2 \leq 300$ mmHg; (4) critically severe type:

with any of the following: respiratory failure needing mechanical ventilation, shock, or combination with other organ failure requiring ICU intensive care.

Image acquisition

All patients underwent routine standard chest CT scanning at an initial visit. The examination was mainly conducted at the Optima CT680 scanner (GE Medical Systems, Milwaukee, WI) with 210 mA and 120 kV to obtain 5- and 1-mm axial images. The images of all patients were then input into the "New Coronavirus Pneumonia Intelligent Evaluation System V6.5" software for analysis. The ratio of the volume of GGO, consolidation, and the sum of them to the volume of the whole lung could be automatically calculated, which were represented as R_{GGO} , R_C , and R_{SUM} , respectively. These three parameters were used for subsequent statistical analysis.

Data analysis

In this study, the Kolmogorov-Smirnov test was used to detect the normality of the data, and the Mann-Whitney U test was used for non-normally distributed parameters (including gender, comorbidity, C-reactive protein, albumin, and lung combining with other lesions). The difference in $D_{negative}$ between white blood cells and lymphocytes among different groups were analyzed by one-way analysis of variance (ANOVA). Similarly, the distinction of age, $D_{negative}$ and imaging findings (including R_{GGO} , R_C , and R_{SUM}) in different clinical types were also analyzed by using ANOVA. Taking gender, age, comorbidity, and lung combining with other lesions, R_{GGO} , R_C , and R_{SUM} as independent variables, and $D_{negative}$ as the dependent variable, the multiple linear regression (MLR) analysis was used to explore the relation between chest CT findings and $D_{negative}$, and establish a regression equation. All data analysis was performed with the SPSS software (Version 22.0, IBM, Chicago, IL, USA), and the statistical difference was set at $P < 0.05$.

Results

A total of 201 hospitalized patients with COVID-19 were enrolled in this study, including 79 males and 122 females, with an average age of 56 years (range, 23–87 years). Most patients (75.5%) had fever, and the rest had other clinical symptoms, such as cough, fatigue, sore throat, Headache, etc. Except for three patients who were infected by exposure to people from Wuhan, the remaining patients were residents of Wuhan. 29.9% of patients had one or more chronic diseases, mainly including hypertension, coronary heart disease, diabetes, asthma, hepatitis B, kidney disease and gout etc. Among these 201 patients, it included mild type in one (0.5%), common in 134 (66.7%), severe in 61 (30.3%), and critically severe in the rest five (2.5%). Most patients at the initial diagnosis showed normal white blood cells (70.1%), normal (50.3%) or decreased (32.3%) lymphocytes, normal (40.8%) or increased (41.3%) C-reactive protein, normal (22.4%) or decreased (59.7%) albumin. On chest CT imaging, 178 patients showed bilateral pneumonia, whilst 22 patients had unilateral pneumonia. Each lobe was involved in the lesion for COVID-

19 patients. The chest CT manifestations of four types were showed in **Fig. 1**, and the clinical information, laboratory tests and chest CT findings of all patients were summarized in **Table 1**.

The histogram distribution of D_{negative} in all COVID-19 patients was showed in **Fig. 2**. As revealed in **Table 2**, there was no significant difference in D_{negative} between different groups of gender and lung combination with other lesions ($P = 0.604$ and $P = 0.993$), but the D_{negative} for patients with comorbidity was significantly higher than that of those without (the mean $\pm$ standard deviation was 33.35 ± 14.63 , 27.79 ± 12.89 , $P = 0.007$). Some laboratory indicators, mainly including leukocytes, lymphocytes, C-reactive protein and albumin, which were normal, increased or decreased, were not statistically significant for D_{negative} (all $P > 0.05$).

Common patients were significantly younger than severe and critically severe patients (common vs. severe vs. critically severe: 52.16 ± 14.19 vs. 62.84 ± 13.45 vs. 71.00 ± 12.51 , P was < 0.001 , 0.003 , and 0.210 , respectively). Compared with common patients, the D_{negative} of severe patients was larger (common vs. severe: 25.53 ± 11.33 vs. 37.13 ± 14.35 , $P < 0.001$), and the R_{GGO} , R_{C} , and R_{SUM} on chest CT imaging were also significantly increased (common vs. severe: 6.31 ± 8.95 vs. 19.49 ± 15.26 , 1.60 ± 3.03 vs. 5.78 ± 6.28 , 7.91 ± 11.35 vs. 25.27 ± 20.10 , all $P < 0.001$). Nevertheless, although the D_{negative} , R_{GGO} , R_{C} , and R_{SUM} for critically severe patients were higher than that of common and severe patients, they were not statistically significant (all $P > 0.05$) (see **Table 3** and **Fig. 3**).

Taking clinical characteristics and CT imaging findings as independent variables, the results of MLR analysis of D_{negative} showed that the R value of final model was 0.331 , and the adjusted R^2 value was 0.110 . The detection value of Durbin-Watson was 2.14 , indicating that the equation had a medium intensity fitting. As can be seen in Table 4, the variables of R_{SUM} and the constant were finally included in the model equation as: $y (D_{\text{negative}}) = 22.35 + 0.36 \times R_{\text{SUM}}$.

Discussion

Coronavirus disease 2019 have spread throughout the world execrably. As of April 19, 2020, the statistical data revealed that the mortality rate of COVID-19 infection in China was 5.5% , while for overseas it was about 6.9% , which was much lower than SARS (9.6%) and MERS (37.1%) [4]. However, the transmissibility of COVID-19 virus was much higher than SARS and MERS, and its incubation period was also long, causing a large number of asymptomatic infections. This could make huge challenges for the diagnosis and control of the disease, posing a great threat to the safety of human life worldwide.

Herein, this study revealed that common patients were much younger ($P < 0.001$ and 0.003), and the D_{negative} of common patients was smaller than that of severe and critically severe patients. The clinical symptoms of common patients were relatively mild, and after receiving corresponding treatment, the virus in the body could be quickly removed. But for severe and critically severe patients, they were more

seriously ill at an initial visit and suffered from impaired respiratory status. Thus their prognosis would be worse[1].

The study of Liu et al.[7] confirmed that the age of COVID-19 infected patients whose disease progressed during hospitalization was significantly higher than that of patients with disease improvement/stabilization. Due to the older age and reduced body immunity, severe and critically severe patients were more vulnerable to virus attacks. Although the D_{negative} of critically severe patients higher than that of common and severe patients, they were not statistically different. This was mainly due to the small sample size of the critically severe patients (only 5 cases), which was greatly lower than the other two types.

Moreover, the chest CT examination played a key role in the diagnosis of COVID-19 infection, and its sensitivity was as high as 97%-98%[5, 8]. Many previous studies[9-12] reported the chest CT imaging features of COVID-19 patients, but most of them only described the lesion morphologically, such as the location, shape, range, and density etc. of the lesions, and lacked to quantify the lesions. However, this study was aimed to classify and quantify the lesions, and confirmed that the R_{GGO} , R_{C} , and R_{SUM} of the lesions of common patients at an initial visit were significantly lower than that of severe patients. When the virus invaded the body, it would produce a series of inflammatory reactions, which can be seen on chest CT as exudation, consolidation, and even fibrosis. The more lesions on the lungs, the greater the damage to the lungs. The lung blood exchange was more restricted, which gave rise to more severe clinical manifestations. As a result, the chest CT of severe patients showed higher R_{GGO} , R_{C} , and R_{SUM} . However, these ratios did not reach statistical significance between common, severe and critically severe patients, mainly because of too small sample size of critically severe patients. Therefore, it can be reasonably inferred from this study that these ratios had potential value in the differential diagnosis of common and severe patients that infected with COVID-19.

The laboratory tests of COVID-19 patients mainly showed normal white blood cells, normal or decreased lymphocytes, increased or normal C-reactive protein, normal or decreased albumin, which was consistent with previous results [1, 13, 14]. These laboratory results differ from those of a common bacterial infection in the lung, particularly lymphocytes, which may be related to the pathogenesis of the virus. We believed that the laboratory indicators at an initial visit could only be used to assist in the diagnosis of COVID-19 infection, but it couldn't be used to determine D_{negative} .

It was worth noting that 29.9% of the patients in this study had one or more comorbidities, which was less than half of the patients in MERS-CoV [15]. This result also showed that the D_{negative} of patients with comorbidity was significantly higher than that of those without ($P = 0.006$). The comorbidity in this study mainly included cardiovascular and cerebrovascular diseases, diabetes, and kidney disease, which was similar to those previous reports[7, 15]. The cause of these comorbidities may be related to the pathogenesis of COVID-19 which may downregulate the key mediators of host's innate immune response to the pathogenesis. These comorbidities shared some common features with infectious diseases and their complications, such as endothelial dysfunction, proinflammatory factor status, and weakened

innate immune response[16, 17]. As a result, it may lead to prolonged virus clearance in the body. We believed that the comorbidities may not be a susceptible factor for patients infected with the COVID-19 virus, but it would prolong the D_{negative} of patients, so it was necessary to long-term observe the nucleic acid change of patients with comorbidities clinically.

The chest CT examination played an important role in diagnosing COVID-19 infection and evaluating the therapeutic effect of patients. It was a current trend to use big data analytics to discern and quantify the lesions of patients with COVID-19 infection, which could not only further improve the accuracy of radiologists in the diagnosis of pulmonary lesions, but also observe subtle changes in lesions that were difficult to be recognized by the naked eye during the follow-up examination. By performing the MLR analysis of the ratio of lesions on the initial chest CT and D_{negative} , an effective correlation equation was obtained as $y(D_{\text{negative}}) = 22.35 + 0.36 \times R_{\text{SUM}}$. This equation suggested that the ratio of lesions on chest CT at the first visit had some potential prediction on patients' D_{negative} . Although there have been scarce data to support the finding to date, continued observations and further assessment are needed, and we believe that it could provide some reference for clinical practice.

This study also had some limitations. Firstly, the sample of mild and critically severe COVID-19 patients was too small to analyze, which couldn't reflect the real clinical features and imaging findings. Secondly, due to the shortage of early medical resources, many patients didn't go to the doctor timely, which resulted in the inconsistency of the time from the onset to the diagnosis and the chest CT examination.

Conclusions

In this study, there was no significant difference in D_{negative} between different groups of gender and lung combination with other lesions ($P = 0.604$ and 0.993), but the D_{negative} for patients with comorbidity was significantly higher than that of those without ($P = 0.007$). Some laboratory indicators, mainly including leukocytes, lymphocytes, C-reactive protein and albumin, were not statistically significant for D_{negative} (all $P > 0.05$). As compared to common patients, severe patients were older, and they had larger D_{negative} ($P < 0.001$), and the R_{GGO} , R_{C} , and R_{SUM} of lesions on chest CT increased significantly (all $P < 0.001$). The MLR analysis equation was $y(D_{\text{negative}}) = 22.35 + 0.36 \times R_{\text{SUM}}$. All these may suggest that the chest CT findings at initial diagnosis could be used to differentially diagnose the common and severe patients, and had certain potential ability in predicting D_{negative} .

Abbreviations

COVID-19: Coronavirus disease 2019

D_{negative} : the number of days that nucleic acids turned negative

GGO: the ground-glass opacity

R_{GGO} : The ratio of the volume of GGO to the volume of the whole lung

R_C : The ratio of the volume of consolidation to the volume of the whole lung

R_{SUM} : The ratio of the sum volume of GGO and consolidation to the volume of the whole lung

ANOVA: One-way analysis of variance

MLR: The multiple linear regression analysis

Declarations

Ethics approval and consent to participate

This study was approved by the institutional review board of the designated hospital, and written informed consent was waived for the retrospective study.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analyzed during this study are included in this published article. The detailed datasets are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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No funding was provided for this study.

Authors' contributions

Fen Xing collected, analyzed data and wrote the manuscript. Jing Zhang collected some data, reviewed and revised the manuscript. Bing Wang collected some data, reviewed and revised the manuscript. Jingyun Cheng collected some data, reviewed and revised the manuscript. Baojun Xie designed the study, and revised the manuscript.

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References

1. Guan W-j, Ni Z-y, Hu Y, Liang W-h, Ou C-q, He J-x, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. *New England Journal of Medicine*. 2020;
2. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet*. 2020; 395: 497-506
3. Shi S, Qin M, Shen B, Cai Y, Liu T, Yang F, et al. Association of Cardiac Injury With Mortality in Hospitalized Patients With COVID-19 in Wuhan, China. *JAMA Cardiol*. 2020;
4. Fang Z, Yi F, Wu K, Lai K, Sun X, Zhong N, et al. Clinical Characteristics of 2019 Coronavirus Pneumonia. 2020;
5. Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. *Radiology*. 2020; 200642
6. Lin L, Li TS. [Interpretation of "Guidelines for the Diagnosis and Treatment of Novel Coronavirus (2019-nCoV) Infection by the National Health Commission (Trial Version 5)"]. *Zhonghua yi xue za zhi*. 2020; 100: E001
7. Liu W, Tao ZW, Lei W, Ming-Li Y, Kui L, Ling Z, et al. Analysis of factors associated with disease outcomes in hospitalized patients with 2019 novel coronavirus disease. *Chin Med J (Engl)*. 2020;
8. Fang Y, Zhang H, Xie J, Lin M, Ying L, Pang P, et al. Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR. *Radiology*. 2020; 200432
9. Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N, et al. Chest CT Findings in Coronavirus Disease-19 (COVID-19): Relationship to Duration of Infection. *Radiology*. 2020; 200463
10. Wang Y, Dong C, Hu Y, Li C, Ren Q, Zhang X, et al. Temporal Changes of CT Findings in 90 Patients with COVID-19 Pneumonia: A Longitudinal Study. *Radiology*. 2020; 200843
11. Lin C, Ding Y, Xie B, Sun Z, Li X, Chen Z, et al. Asymptomatic novel coronavirus pneumonia patient outside Wuhan: The value of CT images in the course of the disease. *Clin Imaging*. 2020; 63: 7-9
12. Xu YH, Dong JH, An WM, Lv XY, Yin XP, Zhang JZ, et al. Clinical and computed tomographic imaging features of novel coronavirus pneumonia caused by SARS-CoV-2. *J Infect*. 2020; 80: 394-400
13. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *The Lancet*. 2020; 395: 507-13
14. Liu K, Fang YY, Deng Y, Liu W, Wang MF, Ma JP, et al. Clinical characteristics of novel coronavirus cases in tertiary hospitals in Hubei Province. *Chin Med J (Engl)*. 2020;
15. Badawi A, Ryoo SG. Prevalence of comorbidities in the Middle East respiratory syndrome coronavirus (MERS-CoV): a systematic review and meta-analysis. *Int J Infect Dis*. 2016; 49: 129-33
16. Htun NS, Odermatt P, Eze IC, Boillat-Blanco N, D'Acremont V, Probst-Hensch N. Is diabetes a risk factor for a severe clinical presentation of dengue?—review and meta-analysis. *PLoS Negl Trop Dis*. 2015; 9: e0003741

17. Dharmashankar K, Widlansky ME. Vascular endothelial function and hypertension: insights and directions. *Curr Hypertens Rep.* 2010; 12: 448-55

Tables

Table 1 All patients' clinical information, laboratory tests, and imaging findings

			Patients (201 cases)
Clinical information	Demographic information	Mean Age (age range)	56 (23-87)
		Male	79 (39.3%)
		Female	122 (60.7%)
	Clinical symptoms	Fever	152 (75.5%)
		Cough	18 (9.0%)
		Fatigue	11 (5.5%)
		Sore throat	4 (2.0%)
		Headache	3 (1.5%)
		Diarrhoea	2 (1.0%)
		Chest distress	2 (1.0%)
		Loss of appetite	1 (0.5%)
		None	8 (4.0%)
	Exposure history	live in Wuhan	197 (98.0%)
		contact with Wuhan people	3 (1.5%)
		hospital infection	1 (0.5%)
	Comorbidity	No	141 (70.1%)
		Yes	60 (29.9%)
	Clinical classification	Mild type	1 (0.5%)
		Common type	134 (66.7%)
		Severe type	61 (30.3%)
		Critically severe type	5 (2.5%)
Laboratory test	White blood cell	Normal	141 (70.1%)
		Decreased	19 (9.5%)
		Increased	10 (5.0%)
		Unclear	31 (15.4%)
	Lymphocyte	Normal	101 (50.3%)

		Decreased	65 (32.3%)
		Increased	4 (2.0%)
		Unclear	31 (15.4%)
C-reactive protein		Normal	82 (40.8%)
		Decreased	0
		Increased	83 (41.3%)
		Unclear	36 (17.9%)
Albumin		Normal	45 (22.4%)
		Decreased	120 (59.7%)
		Increased	0
		Unclear	36 (17.9%)
Imaging findings	Lung combined other lesions	No	186 (92.5%)
		Yes	15 (7.5%)
	Lesions distribution	Both lungs	172 (85.6%)
		Left lung	11 (5.4%)
		Right lung	17 (8.5%)
		None	1 (0.5%)
	Pulmonary lobe	Left upper lobe	152
		Left lower lobe	173
		Right upper lobe	149
		Right middle lobe	137
		Right lower lobe	176

Table 2 The difference of D_{negative} between different groups of clinical information, laboratory tests, and imaging findings

			Mean±standard deviation	<i>P</i> value
Clinical information	Gender	Male	28.94±13.81	0.604 ^a
		Female	29.79±13.57	
	Comorbidity	No	27.79±12.89	0.007 ^a
		Yes	33.35±14.63	
Laboratory test	White blood cell	Normal	30.92±13.41	0.615 ^b
		Decreased	33.95±13.44	
		Increased	29.50±17.89	
	Lymphocyte	Normal	30.52±12.19	0.818 ^b
		Decreased	32.03±15.65	
		Increased	33.75±16.92	
	C-reactive protein	Normal	30.15±11.44	0.236 ^a
		Increased	33.31±15.07	
	Albumin	Normal	29.18±11.90	0.287 ^a
		Decreased	32.45±14.17	
Imaging findings	Lung combined other lesions	No	29.45±13.63	0.993 ^a
		Yes	29.53±14.18	

D_{negative} indicated the number of days that nucleic acids turned negative. ^a indicated the test of Mann-Whitney U ^b indicated the test of Kruskal-Wallis.

Table 3 The ANOVA analysis of age, D_{negative} , and imaging findings among different clinical types

Clinical types	Common	Severe	Critically severe	$P1$ (Common vs Severe)	P2 (Common vs. Critically severe)	P3 (Severe vs Critically severe)
Age(year)	52.16±14.19	62.84±13.45	71.00±12.51	<0.001	0.003	0.209
D_{negative} (days)	25.53±11.33	37.13±14.35	41.00±18.95	<0.001	0.322	0.955
R_{GGO} (%)	6.31±8.95	19.49±15.26	27.07±27.28	<0.001	0.365	0.898
R_C (%)	1.60±3.03	5.78±6.28	5.38±5.17	<0.001	0.393	0.998
R_{SUM} (%)	7.91±11.35	25.27±20.10	32.46±32.18	<0.001	0.363	0.942

ANOVA: One-way analysis of variance; D_{negative} : the number of days that nucleic acids turned negative; R_{GGO} , R_C , and R_{SUM} were respectively indicated the ratio of ground-glass opacity (GGO), consolidation, and the sum of GGO and consolidation of the lesions on chest CT.

Table 4 The Multiple linear regression analysis of clinical features, imaging findings and D_{negative}

Model	Coefficient	Standard error	Standard coefficient	P value	Collinearity statistics (VIF)
(constant)	22.35	3.87		<0.001	
Gender	2.62	1.89	0.1	0.168	1.05
Age	0.02	0.07	0.03	0.729	1.38
Comorbidity	2.33	2.22	0.08	0.296	1.27
Lung combining with other lesions	-3.23	3.69	-0.06	0.383	1.11
R_C	-0.52	0.38	-0.18	0.173	3.99
R_{SUM}	0.36	0.11	0.47	<0.001	4.33

Dependent variable: D_{negative} (the number of days that nucleic acids turned negative); R_C , and R_{SUM} were respectively indicated the ratio of consolidation, and the sum of ground-glass opacity (GGO) and consolidation of the lesions on chest CT.

Figures

Figure 1

a-c: 57-year male patients, who was diagnosed mild type, and with no obvious imaging manifestations. d-f: 31-year male patients, who was diagnosed common type. There was few patchy ground-glass opacity in the lower lobes of both lungs on chest CT. g-i: 69-year male patients, who was diagnosed severe type. There was multiple patchy ground-glass opacity in the all lobes of right lung. J-l: 80-year female patients, who was diagnosed critically severe type. There was diffuse patchy ground ground-glass opacity and few consolidation in all lobes of both lungs.

Figure 2

The histogram of the number of days that nucleic acids turned negative (D_{negative}).

Figure 3

The bar chart of age, D_{negative} , and imaging findings among different clinical types. Severe patients were older than common patients (a), and had larger D_{negative} (b). On chest CT, the R_{GGO} (c), R_{C} (d), and R_{SUM} (e) of severe patients were significantly higher than common patients. D_{negative} : the number of days that nucleic acids turned negative; R_{GGO} , R_{C} , and R_{SUM} were respectively indicated the ratio of ground-glass opacity (GGO), consolidation, and the sum of GGO and consolidation of the lesions on chest CT.