INTRODUCTION

Several patients with pneumonia of unknown causes, but all sharing a history of exposure to the Seafood Market in some hospitals in Wuhan, Hubei in December 2019. This pneumonia has been demonstrated to be an acute respiratory infection caused by infection with the 2019 novel coronavirus, of which the homology with the coronavirus inducing SARS was over 85%. In humans, this virus mainly invades the respiratory system and induces the novel coronavirus infected pneumonia, which has been formally named “Coronavirus Disease 2019” (COVID-19) by the World Health Organization (WHO) on 11 February 2020. The infection reached the status of a controllable pandemic on 11 March 2020, with 125 048 cases and 4613 deaths worldwide.

The transmission of SARS-CoV-2 is mainly depend on the human to human transmission, including the patients infected with the novel coronavirus and asymptomatic carriers. The transmission routes mainly include droplet transmission through the respiratory...
tract and close contact. In addition, long-time exposure to high-concentration aerosol in a relatively closed room could also lead to aerosol transmission. COVID-19 is highly infectious, and most people are generally susceptible.\(^5\)\(^,\)\(^6\) The main clinical symptoms of COVID-19 are fever, dry cough and weakness, whereas nasal congestion, running nose, pharyngalgia and diarrhoea could also occur in some patients.\(^7\) In addition, dyspnoea could appear in severe patients a week after occurrence of disease, and even progress to acute respiratory distress syndrome (ARDS), septic shock, uncorrectable metabolic acidosis, coagulation disorders and multiple organ failure in critical cases.\(^5\)\(^,\)\(^6\)

Rapid diagnosis COVID-19 and isolation of patients are important for controlling the spread of this disease. Currently, the diagnosis of COVID-19 mainly depends on nucleic acid testing,\(^9\)\(^-\)\(^11\) which is limited. Firstly, the test requires that the specimen shipped to a laboratory offering the test and then waiting for the test result, leading to delays in the confirmation of the infection. Secondly, the positive rate is relatively low, and false-negative is often found.\(^9\)\(^-\)\(^12\) Therefore, Guidelines of COVID-19 Diagnosis and Treatment (6th trial version) issued by the National Health Commission of the People's Republic of China had defined the diagnosis of viral pneumonia based on radiologic features by CT as one of the diagnostic criteria for COVID-19.\(^13\) However, there are few studies on CT and laboratory indicators in patients in COVID-19.

Therefore, the aim of this study was to examine the imaging and clinical data of patients with COVID-19 to investigate the correlation between CT images and laboratory indicators of COVID-19. We found the chest CT characteristics of patients with COVID-19 correlated positively with CRP, ESR and LDH and these results could provide evidence in helping better diagnosing and treating COVID-19.

### 2 MATERIALS AND METHODS

#### 2.1 Study design and patients

This was a retrospective study of patients with COVID-19 diagnosed and treated at the Affiliated Hospital of Putian University from 24 January 2020 to 6 March 2020. The patients diagnosed by nucleic acid testing according to the Guidelines of COVID-19 Diagnosis and Treatment (6th trial version) issued by the National Health Commission of the People's Republic of China.\(^13\) This study was approved by the ethics committee of Affiliated Hospital of Putian University (approve no. 2020003).

#### 2.2 Grouping

The severity of the pulmonary lesions was classified according to the method of quantitative analysis of high-resolution chest CT images\(^14\): the bilateral lung fields were divided into the upper, middle and lower lungs at the levels of the inferior pulmonary vein and carina, and thus six lung areas were obtained. The proportion of lesions in the corresponding lung area was assessed and scored, a score of 0 indicating normal lung tissues with no evident lesion, a score of 1 indicating the lesion area is 5% of the total area of the corresponding lung, a score of 2 indicating 25%-50%, a score of 3 indicating 50%-75% and a score of 4 indicating >75%. The scores in each lung area were assessed and summed to represent the total scores, which reflected lung CT severity. The highest score possible was 24. When the lesions involved various levels, the scores at different levels were added, and then the average score was calculated. If the lesions in each level of the bilateral lungs showed diffuse ground glass shadows, the score was 24. The scores of all images were assessed by three associate chiefs or higher physicians at the Respiratory Department independently. Disagreements were solved by discussion. The patients were divided into three groups: mild (score 0-3), moderate (score 4-6) and severe (score >6) groups.\(^13\)

#### 2.3 Chest CT imaging

After admission, all the patients underwent high-resolution plain chest CT scanning using a Siemens 64-row CT scanner (Siemens, Erlangen, Germany). The patients were asked to remove all metal materials and placed in the supine position on the scanning table, with both hands raised over the head. They were asked to hold their breath after a deep inspiration, and then the high-resolution plain chest CT scanning was conducted, with the scanning covering the area from the apex to the base of the lung. The scanning parameters were: voltage of 120 kV, current of 100-280 mA, layer thickness of 5 mm, interlayer spacing of 5 mm, collimation of 5 mm, screw pitch of 1 mm, field of view of 30 cm, matrix of 512 × 512, lung window width of +1500 HU, and lung window level of −500 HU, mediastinal window width of +300 HU, and
mediastinal window level of +10 Hu. Multiplanar reconstruction for some patients was conducted according to the chest CT findings, with the reconstruction parameters: layer thickness of 1.0 mm, interlayer spacing of 0.7 mm, lung window of B70f, and reconstruction function of D30f.

2.4 | Clinical examination

Pharyngeal test paper or sputum samples were collected from all patients on the day after admission in the morning. The samples were subjected to PCR in the clinical laboratory for the novel coronavirus, using the real-time PCR method. The samples with positive results were examined again at the Putian Center for Disease Control (CDC), and the cases were considered as positive if the re-examination still showed positive results.

2.5 | Laboratory examinations

Analysis of blood cell, CRP, biochemistry analyses, ESR and T-Ls were executed by the professionals in the clinical laboratory of our hospital, using standard routine methods. Analysis of blood cell and CPR were measured with ABX Micros CRP 200 automatic blood cell analyser and quantitative CRP analyser (Horiba Scientific, Kyoto, Japan). ESR was measured by XC-A10 automatic erythrocyte sedimentation rate analyser (Pioway Medical Lab Equipment Co., Ltd., Nanjing, China), using the infrared photoelectric technology. T-Ls were measured by the FACSCalibur™ flow cytometer, using the BD Multitest kit (BD Diagnostics, Sparks, MD, USA). The flow cytometry assay is as follows: firstly, the haemolysin provided by the BD Multitest kit was 10-time diluted with deionised water. Then, 20 µL of the BD Multitest CD3/CD8/CD45/D4 reagent was added with 50 µL of anticoagulant blood. After incubation at room temperature in the dark for 15 min, 450 µL of BD Multitest haemolysin was added and incubated at room temperature in the dark for 15 min. The mixture was measured by the BD Facscalibur flow cytometer, strictly according to the instructions of the manufacturer of the BD Multitest kit. The reference ranges of the T-Ls: CD3⁺ T cells: 55%-84%; CD3⁺CD4⁺ T cells: 31%-60%; and CD3⁺CD8⁺ T cells: 13%-41%.

2.6 | Data collection and definitions

After the patients were admitted to the Fever Management Clinic of our hospital, the medical history was obtained, and venous blood was collected for laboratory examinations, including blood routine, C-reactive protein (CRP), routine biochemistry, erythrocyte sedimentation rate (ESR) and T lymphocyte subsets (T-Ls) examinations. Plain chest CT scanning was conducted in accordance with the hospital infection-control requirements.

The severity of COVID-19 was classified as: (1) mild: with only mild clinical manifestations, and imaging examinations showed no signs of pneumonia; (2) moderate: with fever and respiratory symptoms, and imaging examinations showed signs of pneumonia; (3) severe: the patients met one or more of the following items: (i) with respiratory distress, and respiratory rate (RR) ≥30 times/min; (ii) finger oxygen saturation ≤93% in the resting state; and (iii) arterial partial pressure of oxygen (PaO₂)/concentration of oxygen inhalation (FiO₂) ≤300 mm Hg (1 mm Hg = 0.133 kPa) (for high altitude areas (altitude >1000 m), the PaO₂/FiO₂ was adjusted according to the following equation: PaO₂/FiO₂ × [atmospheric pressure (mm Hg)/760]); in addition, the patients in whom pulmonary imaging showed that the lesion progressed >50% within 24-48 hours were also managed as severe cases; and (4) critical: the patients meet one or more of the following items: (i) respiratory failure requiring mechanical ventilation; (ii) shock; and (iii) failure of other organs and required monitoring and treatment in the ICU.

2.7 | Statistical analysis

SPSS 24.0 (IBM, Armonk, NY, USA) was used for statistical analysis. Continuous data with a normal distribution (according to the Kolmogorov-Smirnov test) were described as means and standard deviations and analysed using one-way analysis of variance, with the LSD post hoc test for data with equal variances, and the Games-Howell post hoc test for data with unequal variances. Continuous data with a skewed distribution were described as medians and IQR and analysed using the chi-square test. The Pearson correlation test was performed to assess the associations between continuous data and a normal distribution, while the Spearman correlation test was used to assess the association between continuous data with a skewed distribution. P < .05 (two-sided) was considered statistically significant.

3 | RESULTS

3.1 | Characteristics of the patients

In this retrospective study, 56 patients, diagnosed with COVID-19 from 24 January 2020 to 6 March 2020, were included (Table 1). Among the 56 patients, 36 (64.3%) males and 20 (35.7%) females were included. As shown in Table 1, the mean age of the patients is 46.5 ± 15.8 (range, 15-86). Twenty-seven (48.2%) patients had a history of travel to Wuhan, while 29 (51.8%) patients were with close contact with individuals who travelled to Wuhan. The clinical symptoms of the patients were: fever in 43 (76.8%) patients, cough in 26 (46.4%), weakness in 12 (21.4%), muscular soreness in 5 (8.9%),
pharyngalgia in 2 (3.6%), running nose in 2 (3.6%), nasal congestion in 4 (7.1%), shortness of breath in 3 (5.4%), chest distress in 3 (5.4%), headache in 3 (5.4%) and diarrhoea in 4 (7.1%). In addition, one (1.8%) patient was admitted to our hospital for toothache. Twenty-eight patients were with comorbidities: hypertension in 10 patients (17.9%), diabetes in 5 (8.9%), chronic hepatitis in 4 (7.1%), chronic obstructive pulmonary disease (COPD) in 3 (5.4%), fatty liver in three (5.4%), chronic disease in 2 (3.6%) and space-occupying gastric disorder in 1 (1.8%).

According to the disease severity scores, 0 (0%), 50 (89.3%), 4 (7.1%) and 2 (3.6%) patients were classed into mild, regular, severe and critical COVID-19, respectively.

### TABLE 1

| Variables | Patients (N = 56) | Regular (N = 50) | Severe (N = 4) | Critical (N = 2) |
|-----------|------------------|-----------------|---------------|-----------------|
| Male      | 36 (64.3%)       | 32 (57.1%)      | 3 (5.4%)      | 1 (1.8%)        |
| Age (y)   | 46.5 ± 15.8      | 44.0 ± 14.0     | 62.0 ± 14.0   | 78.5 ± 10.6     |
| Comorbidities |                  |                 |               |                 |
| Hypertension | 10 (17.9%)      | 8 (14.3%)       | 1 (1.8%)      | 1 (1.8%)        |
| Diabetes   | 5 (8.9%)         | 4 (7.1%)        | 0             | 1 (1.8%)        |
| Chronic hepatitis | 4 (7.1%)      | 4 (7.1%)        | 0             | 0               |
| COPD       | 3 (5.4%)         | 1 (1.8%)        | 1 (1.8%)      | 1 (1.8%)        |
| Fatty liver | 3 (5.4%)         | 3 (5.4%)        | 0             | 0               |
| Space-occupying gastric disorder | 1 (1.8%)      | 1 (1.8%)        | 0             | 0               |
| Source of transmission |                  |                 |               |                 |
| History of travel to Wuhan | 27 (48.2%)      | 25 (44.6%)      | 1 (1.8%)      | 1 (1.8%)        |
| Close contact with individuals who travelled to Wuhan | 29 (51.8%)      | 25 (44.6%)      | 3 (5.4%)      | 1 (1.8%)        |
| Signs and symptoms |                  |                 |               |                 |
| Highest temperature (°C) |                  |                 |               |                 |
| <37.3      | 25 (44.6%)       | 23 (41%)        | 1 (1.8%)      | 1 (1.8%)        |
| 37.3–38.0  | 18 (32.1%)       | 17 (30.4%)      | 1 (1.8%)      | 0               |
| 38.1–39.0  | 12 (21.4%)       | 9 (16.0%)       | 2 (3.6%)      | 1 (1.8%)        |
| >39.0      | 1 (1.8%)         | 1 (1.8%)        | 0             | 0               |
| Respiratory rate (>24 breaths per min) | 15 (26.8%)      | 10 (17.9%)      | 3 (5.4%)      | 2 (3.6%)        |
| Systolic pressure (mm/Hg) | 134 (103-175)   | 122 (103-155)   | 145 (118-156) | 161 (143-175)   |
| Admission heart rate (beats/min) | 90 (61-119)     | 93 (61-119)     | 89 (74-98)    | 77 (76-78)      |
| Fever      | 43 (76.8%)       | 39 (69.6%)      | 3 (5.4%)      | 1 (1.8%)        |
| Cough      | 26 (46.4%)       | 21 (37.5)       | 3 (5.4%)      | 2 (3.6%)        |
| Weakness   | 12 (21.4%)       | 11 (19.6%)      | 1 (1.8%)      | 0               |
| Muscular soreness | 5 (8.9%)       | 0               | 4 (7.1%)      | 1 (1.8%)        |
| Pharyngalgia | 2 (3.6%)         | 2 (3.6%)        | 0             | 0               |
| Running nose | 2 (3.6%)         | 0               | 2 (3.6%)      | 0               |
| Nasal congestion | 4 (7.1%)        | 4 (7.1%)        | 0             | 0               |
| Shortness of breath | 3 (5.4%)         | 1 (1.8%)        | 1 (1.8%)      | 1 (1.8%)        |
| Chest distress | 3 (5.4%)         | 3 (5.4%)        | 0             | 0               |
| Headache   | 3 (5.4%)         | 2 (3.6%)        | 0             | 1 (1.8%)        |
| Diarrhoea  | 4 (7.1%)         | 3 (5.4%)        | 1 (1.8%)      | 0               |

Abbreviation: COPD, chronic obstructive pulmonary disease.
### 3.2 Chest CT imaging results

The chest CT imaging of the 56 patients showed that the lesions affected bilateral lung fields in 44 (78.6%) patients and unilateral lung field in 11 (19.6%) patients, whereas 1 (1.8%) was with no evident lesion (Table 2). The lesions were in the upper lung field, middle lung field, low lung field, middle and low lung fields, and whole lung in two (3.6%), 13 (23.2%), 30 (53.6%), 5 (8.9%) and 5 (8.9%) patients, respectively, while one patient (1.8%) was with no evident lesion (Table 2). The lesions were multiple patchy opacities in 49 (87.5%) patients and ground-glass opacities in 32 (57.1%). The lesions were accompanied with partial consolidation in 20 (35.7%) patients, air bronchogram in 2 (3.6%) and gravel syndrome in 1 (1.8%) (Table 2). No patient had pleural effusion.

### 3.3 Clinical characteristics

As shown in Table 3, the patients were older with increasing disease severity. In addition, the levels of CRP, LDH and creatinine (Cr) in peripheral blood also increase with disease severity. Age, Cr and CRP in...
the severe group are significantly higher than in the mild group \((P < .05)\). The levels of LDH are significantly higher in severe group than moderate and mild groups \((P < .05)\). The white blood cell count, absolute lymphocyte count, ALT and AST are not significantly different among different groups \((P > .05)\).

### 3.4 | Comparison of T-Ls

As shown in Table 4, the CT scores and ESR value increased gradually from the mild to the severe group, and the mean CT score was significantly different among the three groups. The CT score in the moderate group was higher than mild group \((P < .05)\), and higher in the severe group than moderate and mild groups \((P < .05)\). In addition, the ESR value was significantly higher in the severe group than the mild group \((P < .05)\). The CD4 cells decreased gradually with the disease severity, but the difference was not statistically significant \((P > .05)\). The CD3, CD8 and CD4/CD8 cells were also not significantly different among the three groups \((P > .05)\).

### 3.5 | Correlation analyses

Correlation analyses were performed for the data with significant differences, including CT score, CRP, Cr, LDH and ESR. The results showed that the CT score of the patients was positively correlated with CRP, LDH and ESR \((all \ P < .01)\), LDH was highly positively correlated with CT score, Cr, CRP and ESR \((all \ P < .01)\) (Table 5).

### DISCUSSION

Viral nucleic acid testing is playing a valuable role in helping test COVID-19. However, nucleic acid testing has a relative complex process and requires a long time before results are available. In addition, some nucleic acid test cases with risk of false-negative, which is harmful to the control of COVID-19. Therefore, this study aimed to explore the correlation between chest CT images and laboratory indicators of patients with COVID-19 pneumonia. The results showed that chest CT characteristics of patients with COVID-19 correlated with CRP, ESR and LDH, and could be used as one of the indicators for the assessment of disease severity.

Since the outbreak of COVID-19 in Wuhan in December 2019, this disease spread in other areas in China and other countries, with Italy and Iran being particularly affected. The infection reached the status of a controllable pandemic on 11 March 2020, with 125 048 cases and 4613 deaths worldwide. The occurrence of COVID-19 in China generally involves an evident history of direct or indirect contact with Wuhan. Among the 56 patients in this study, 28 had a history of living or travelling in Wuhan, while the other 28 patients had an evident history of close contact with infected patients (Table 1). Thirty-six (64%) of the patients were males, suggesting males were more common in the patients, which was in agreement with previous findings.\(^{15}\)

Our chest CT images results showed that patients with COVID-19 mainly showed multiple patchy lesions and ground-glass opacities, which were mainly in the lower outer pulmonary zones of bilateral lungs (Table 2). Some patients accompanied with consolidation, but no pleural effusion, which was in agreement with previous findings.\(^{16-22}\) In a multicentre study of 149 patients, the major lesions were ground-glass opacities, mixed opacity and consolidation.\(^{21}\) Beyond above report CT lesions observed in patients with COVID-19, the present study showed that the CT score\(^{13}\) was closely associated with disease severity.

The age of the patients gradually increased from the mild to the severe group, while the CRP, ESR, Cr and LDH levels in the peripheral blood also increased gradually, suggesting that the CT severity and inflammatory indicators were higher, renal function was poorer and disease was more severe in older patients. We speculated that these findings could be associated with the fact that elderly patients had higher risks of comorbidities, such as hypertension,
diabetes and COPD. Therefore, Guidelines of COVID-19 Diagnosis and Treatment (6th trial version) issued by the National Health Commission of the People's Republic of China suggest that the prognosis of elderly and chronic patients underlying diseases are poorer, which is in agreement with our findings (Table 1). The decrease of white blood cell and absolute lymphocyte count is one of the characteristics of COVID-19 patients. Nevertheless, the present study also showed that the white blood cell and absolute lymphocyte count were not significantly different among the severity groups (Table 4), suggesting that those cannot be used as an indicator of disease severity of COVID-19. Further analysis of the peripheral T-Ls in the patients showed that CD3, CD4 and CD8 cells were not different across the groups. In addition, CD8 cells were not significantly different among the different groups (Table 4). Xu et al analysed the peripheral blood of COVID-19 patients with flow cytometry and found that the counts of CD4⁺ and CD8⁺ cells decreased substantially, while the lymphocytes were over-activated. These findings could partially explain the severe immune damages in the lungs of COVID-19 patients. The lack of difference in the present study could be relatively small sample size and low number of severe disease patients.

CRP is an acute-phase protein synthesised by hepatocytes upon inflammatory stimulations and is widely applied in clinical practices as an inflammatory indicator. High CRP levels in COVID-19 patients often suggest more severe diseases. LDH is a glycolytic enzyme that mainly catalyses the oxidation of lactic acid to pyruvic acid. Previous studies have conducted autopsy in COVID-19 patients and found that the lungs showed diffuse alveolar damage and hyaline membrane formation, which were in agreement with the symptoms of ARDS. These findings suggested that the increase of LDH in COVID-19 patients could be associated with the release of LDH into the blood because of diffuse alveolar damage. In addition, the accumulation of lactic acid induced by hypoxia could also promote the release of LDH through feedback, which could also contribute to pathological changes. Xi et al showed that LDH as an independent risk factor predicting the mortality of patients with H1N1 pneumonia, and LDH was also an effective indicator for the assessment of the severity of H1N1 infected pneumonia. Another study showed that LDH increase was more evident in patients with larger areas of lesions in the lungs. Both COVID-19 and H1N1 pneumonia are viral pneumonia, and they share several common characteristics. The findings of this study showed that the chest CT severity of patients with COVID-19 was positively correlated with LDH levels, suggesting that chest CT severity and LDH level could be among the indicators that could help to assess disease severity. ESR is an indicator of plasma viscosity. The ESR is faster when the erythrocyte aggregation is higher, and slower when the erythrocyte aggregation is lower, suggesting that the elevated plasma viscosity could be associated with the release of high-amount inflammatory factors. The findings of this study showed that LDH, ESR and CRP were all positively correlated, suggesting that these three indicators are closely associated with the severity of COVID-19. The correlation test further showed that the severity of CT correlated positively with CRP, ESR and LDH in patients with COVID-19, suggesting that it could be used as an indicator reflecting the disease severity of patients with COVID-19.

This study has some limitations. The sample size was small, and all patients were from a single institution. The data were collected retrospectively, introducing the biases inherent to such an approach. CT is widely used in the emergency setting because it is fast and accurate, but other imaging modalities also could be explored.

In summary, chest CT severity of patients with COVID-19 is closely correlated with COVID-19 severity, CRP, LDH and ESR, and could be an indicator assessing the severity of COVID-19. These results provide evidence in helping improve diagnosing and treating COVID-19.

ACKNOWLEDGEMENTS
None.

DISCLOSURE
The authors declare that they have no competing interests.

AUTHORS’ CONTRIBUTIONS
Qunying Lin and Liangning Wu drafted manuscripts; Qunying Lin, Guosheng Lin and Juan Lin were responsible for CT imaging severity assessments; Qunying Lin and Linjing Zhu were responsible for epidemiological data, clinical data collection and statistical analysis of data; Haijian Tu was responsible for blood specimen testing. All authors have read and approved the manuscript.

CONSENT FOR PUBLICATION
Written informed consent to publish this information was obtained from study participants.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES
1. Benvenuto D, Giovanetti M, Ciccozzi A, Spoto S, Angeletti S, Ciccozzi M. The 2019-new coronavirus epidemic: evidence for virus evolution. J Med Virol. 2020;92:455-459.
2. World Health Organization Coronavirus disease 2019 (COVID-19). Situation Report – 21; 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200210-sitrep-21-cnov.pdf?sfvrsn=947679ef_2.2020.
3. World Health Organization Coronavirus disease 2019 (COVID-19). Situation Report – 52; 2020. https://www.who.int/docs/default-source/coronaviruse/20200312-sitrep-52-covid-19.pdf?sfvrsn=e2bfc9c0_2.2020.
4. Tong ZD, Tang A, Li KF, et al. Potential presymptomatic transmission of SARS-CoV-2, Zhejiang Province, China, 2020. Emerg Infect Dis. 2020;26:1052-1054.
5. Cascella M, Rajnik M, Cuomo A, Dulebohn SC, Di Napoli R. Features, Evaluation and Treatment Coronavirus (COVID-19). StatPearls; 2020.
6. Xu Y. Unveiling the origin and transmission of 2019-nCoV. Trends Microbiol. 2020;28:239-240.
7. Centers for Disease Control and Prevention 2019 Novel Coronavirus (2019-nCoV), Wuhan, China (2019). https://www.cdc.gov/coronavirus/2019-nCoV/summary.html

8. Wang D, Hu BO, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020;323:1061-1069.

9. Won J, Lee S, Park M, et al. Development of a laboratory-safe and low-cost detection protocol for SARS-CoV-2 of the Coronavirus Disease 2019 (COVID-19). Exp Neurobiol. 2020;29:402.

10. Wang W, Xu Y, Gao R, et al. Detection of SARS-CoV-2 in different types of clinical specimens. JAMA. 2020;323:1843-1844.

11. Chan JF, Yip CC, To KK, et al. Improved molecular diagnosis of COVID-19 by the novel, highly sensitive and specific COVID-19-RdRp/Hel real-time reverse transcription-polymerase chain reaction assay validated in vitro and with clinical specimens. J Clin Microbiol. 2020;58:e00310-20.

12. Liu R, Han H, Liu F, et al. Positive rate of RT-PCR detection of SARS-CoV-2 infection in 4880 cases from one hospital in Wuhan, China, from Jan to Feb 2020. Clin Chim Acta. 2020;505:172-175.

13. National Health Commission of the People’s Republic of China website Diagnosis and treatment of novel coronavirus infection (trial version 6); 2020. http://www.nhc.gov.cn/yzygj/s7653p/20202/8334a8326dd94d329df351d7da8aefc2.shtml.

14. Casarini M, Ameglio F, Alemanno L, et al. Cytokine levels correlate with a radiologic score in active pulmonary tuberculosis. Am J Respir Crit Care Med. 1999;159:143-148.

15. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395:497-506.

16. Chen R, Chen J, Meng QT. Chest computed tomography images of early coronavirus disease (COVID-19). Can J Anaesth. 2020;67:754-755.

17. Li W, Cui H, Li K, Fang Y, Li S. Chest computed tomography in children with COVID-19 respiratory infection. Pediatr Radiol. 2020;50:796-799.

18. An P, Song P, Lian K, Wang Y. CT manifestations of novel coronavirus pneumonia: a case report. Balkan Med J. 2020;37:163-165.

19. Xia W, Shao J, Guo Y, Peng X, Li Z, Hu D. Clinical and CT features in pediatric patients with COVID-19 infection: different points from adults. Pediatr Pulmonol. 2020;55:1169-1174.

20. Dai WC, Zhang HW, Yu J, et al. CT imaging and differential diagnosis of COVID-19. Can Assoc Radiol J. 2020;71:195-200.

21. Yang W, Cao Q, Qin LE, et al. Clinical characteristics and imaging manifestations of the 2019 novel coronavirus disease (COVID-19): a multi-center study in Wenzhou city, Zhejiang, China. J Infect. 2020;80:388-393.

22. Lin X, Geng Z, Xiao Z, Xiong J, Fan B, Liu J. Novel coronavirus pneumonia outbreak in 2019: computed tomographic findings in two cases. Korean J Radiol. 2020;21:365-368.

23. Xu Z, Shi L, Wang Y, et al. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. Lancet Respir Med. 2020;8:420-422.

24. Sproston NR, Ashworth JJ. Role of C-reactive protein at sites of inflammation and infection. Front Immunol. 2018;9:754.

25. Li LQ, Huang T, Wang YQ, et al. COVID-19 patients’ clinical characteristics, discharge rate, and fatality rate of meta-analysis. J Med Virol. 2020;92:577-583.

26. Liu Y, Yang Y, Zhang C, et al. Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury. Sci China Life Sci. 2020;63:364-374.

27. Jialal I, Sokoll LJ. Clinical utility of lactate dehydrogenase: a historical perspective. Am J Clin Pathol. 2015;143:158-159.

28. Xi X, Xu Y, Jiang L, Li A, Duan J, Du B; Chinese Critical Care Clinical Trial Group. Hospitalized adult patients with 2009 influenza A(H1N1) in Beijing, China: risk factors for hospital mortality. BMC Infect Dis. 2010;10:256.

29. Cho WH, Kim YS, Jeon DS, et al. Outcome of pandemic H1N1 pneumonia: clinical and radiological findings for severity assessment. Korean J Intern Med. 2011;26:160-167.

30. Gulhar R, Jialal I. Physiology, Acute Phase Reactants. StatPearls; 2020.

How to cite this article: Lin Q, Wu L, Lin W, et al. Correlation between chest CT severity score and laboratory indicators in patients with Coronavirus disease 2019 (COVID-19). Int J Clin Pract. 2021;75:e14907. doi:10.1111/ijcp.14907