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Clinical and CT imaging features of 2019 novel coronavirus disease (COVID-19)

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The authors declare that they have no competing interests.

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Dear Editor,

Tang JW, et al. and colleagues have written to this Journal describing the emergence of 2019 novel coronavirus disease (COVID-19)[1]. We have had an opportunity to examine in detail the chest computed tomography (CT) findings in cases with microbiologically confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, to familiarize radiologists and clinicians with the imaging manifestations of this new outbreak. Meanwhile, we also studied the clinical characteristics of the cases, combined with CT manifestations, to provide more clues for the correct diagnosis of the disease.

Six female patients (P1-P6) aged from 27 to 63 years were referred to the fever clinic of our hospital. None of the patients had underlying diseases such as diabetes, malignant tumour or respiratory disease. Among the 6 cases, 5 (P1-P5) had a history of exposure to Wuhan or Hubei, and P6 had no clear epidemiological history. All the patients performed oropharyngeal swabs test and confirmed as COVID-19. Common respiratory viruses, mycoplasma and chlamydia were negative. For patients' venous blood tests at disease onset, as given in (Table 1), we found that leucocytes, lymphocytes and percentage were slightly decreased or normal, eosinophil count and percentage were slightly decreased in 4 cases and normal in 2 cases. Additionally, 4 days later, P1 reperformed the follow-up hematologic examination. Compared with the blood test at disease onset, the results showed that the eosinophil count was still below the normal range, which was even lower than the first time.

On admission, all patients underwent high resolution chest CT examination and their manifestations were shown in (Table 2). P1 (Figure 1, F0, A1-A4): CT images showed patchy-like pure ground glass opacity (GGO) involving subpleural regions of the right middle lobe (Figure 1, F0, A3, arrow) and the right lower lobe. The slightly thickened interlobular septa within the lesion makes it appear the crazy paving sign (Figure 1, F0, A2, arrowhead). P2 (Figure 2, P2, A1-A2): CT images showed mixed GGO and consolidation that appeared at subpleural area of the right middle lobe and the right lower lobe. The lesion presented as patchy-like morphology. P3 (Figure 2, P3,

A1-A2): CT images showed two well circumscribed, round nodular-like GGO lesions (Figure 2, P3, arrow) located in the central area of the left upper lobe. P4 (Figure 3, P4): CT images showed a small nodular-like pure GGO (Figure 3, P4, arrow) located in the central area of the left lower lobe. P5 (Figure 3, P5): CT images showed a slight of irregular pure GGO (Figure 3, P5, arrow) located in the subpleural region of the right lower lobe. P6 (Figure 3, P6, A1-A2): CT images showed bilateral multi-focal mixed GGO and consolidation appeared at subpleural area of lung. Mild bronchiectasis (Figure 3, P6, A2, arrow) can also be observed within the lesion.

P1 had three follow-up CTs (Figure 1, F1-F3). The time interval between initial chest CT and follow-up were 4, 8, 14 days. Follow-up 1(Figure 1, F1, B1-B4): CT images showed diseases progression. The lesions showed diversified morphology and distribution, appearing as coexisted nodular-like (Figure 1, F1, B4, arrow) and patchy-like lesions as well as peribronchial (Figure 1, F1, B2, arrowhead), central and subpleural distribution. CT images of F1 showed the that lesions were migratory manifested as the absorption of the primary lesions and the emergence of new lesions. CT images of Follow-up 2 (Figure 1, F2, C1-C4) and Follow-up 3 (Figure 1, F3, D1-D4) showed the diseases were obviously absorbed.

In the current study, we investigated the detailed information including clinical features and CT imaging characteristics of 6 patients with COVID-19. Our research has some new findings on the basis of previous study: (1) The decrease of eosinophil count may be helpful for the early diagnosis of the disease. Nevertheless, till now, there is no study refer to blood tests[2,3] mentioned eosinophil, which is worthy of further study. (2) Our CT study found that COVID-19 has a variety of manifestations. In the early stage of the disease, the lesion can manifest as round nodular-like GGO in the central area of the lung lobe, which is different from the common imaging manifestations that are patchy-like lesion in subpleural region[4-6]. (3) The follow-up CT images showed the lesions are migratory manifested as the absorption of the primary lesions and the emergence of new lesions, which had not been reported yet.

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(4) The false negative rate of oropharyngeal swabs seems high. As we know that, oropharyngeal swabs are the recommended upper respiratory tract specimen types for SARS-CoV-2 diagnostic testing[7,8], so a new detection technique should be developed as soon as possible.

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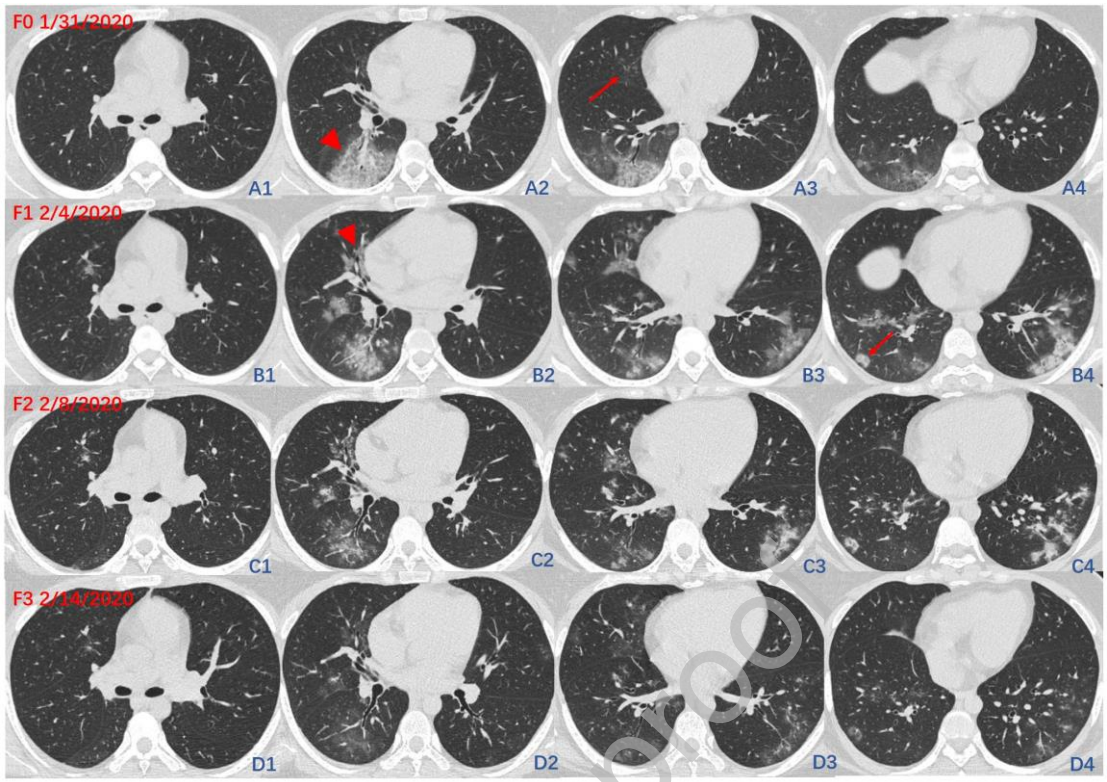

Figure 1 The initial CT images (F0) and three times of follow-up CT images (F1-F3) of P1. F0 showed patchy-like pure GGO located in the subpleural regions of the right middle lobe (F0, A3, arrow) and the right lower lobe, accompanied by crazy paving sign (F0, A2, arrowhead). Follow-up 1(F1, B1-B4): CT images showed diseases progression. The lesions manifested as coexisted nodular-like (F1, B4, arrow) and patchy-like lesions as well as peribronchial (F1, B2, arrowhead), central and subpleural distribution. The lesions are migratory manifested as the absorption of the primary lesions and the emergence of new lesions. CT images of Follow-up 2 (F2, C1-C4) and Follow-up 3 (F3, D1-D4) showed lesion absorption.

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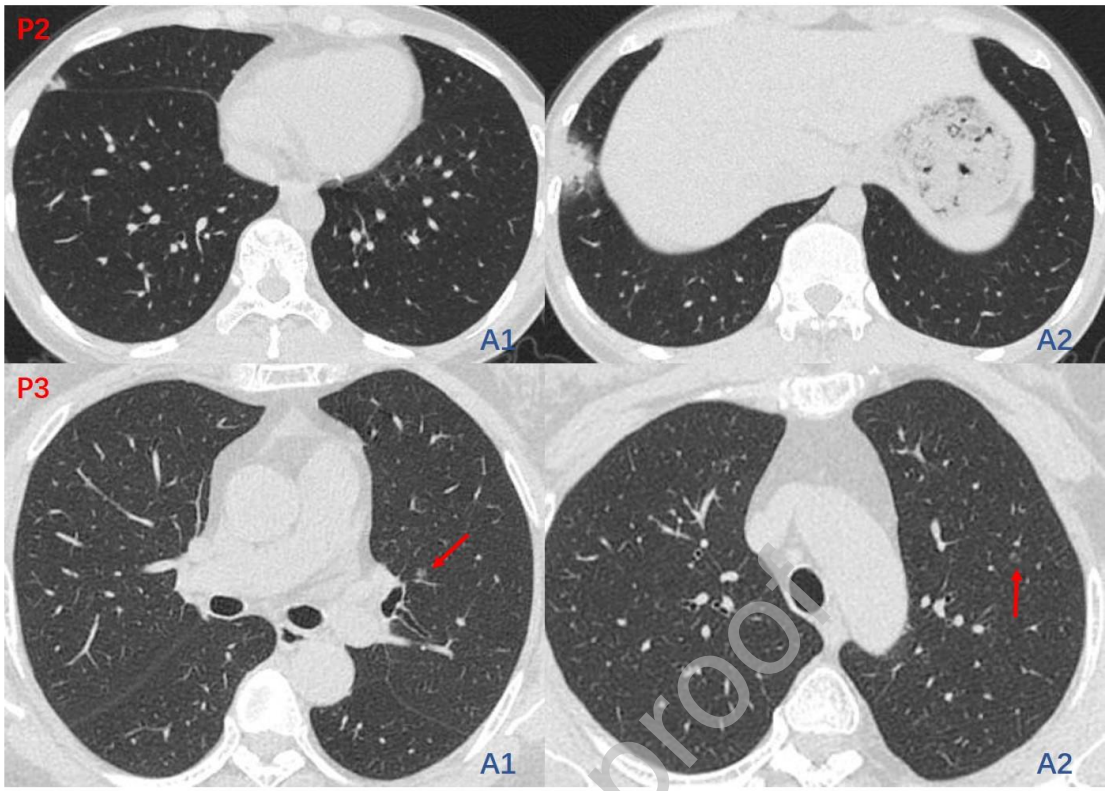

Figure 2 The initial CT images of P2 (P2, A1-A2) and P3 (P3, A1-A2). CT images of P2 showed mixed GGO and consolidation in the subpleural area of the right middle lobe and the right lower lobe. CT images of P3 showed two well circumscribed, round nodular-like GGO lesions (P3, arrow) located in the central area of the left upper lobe.

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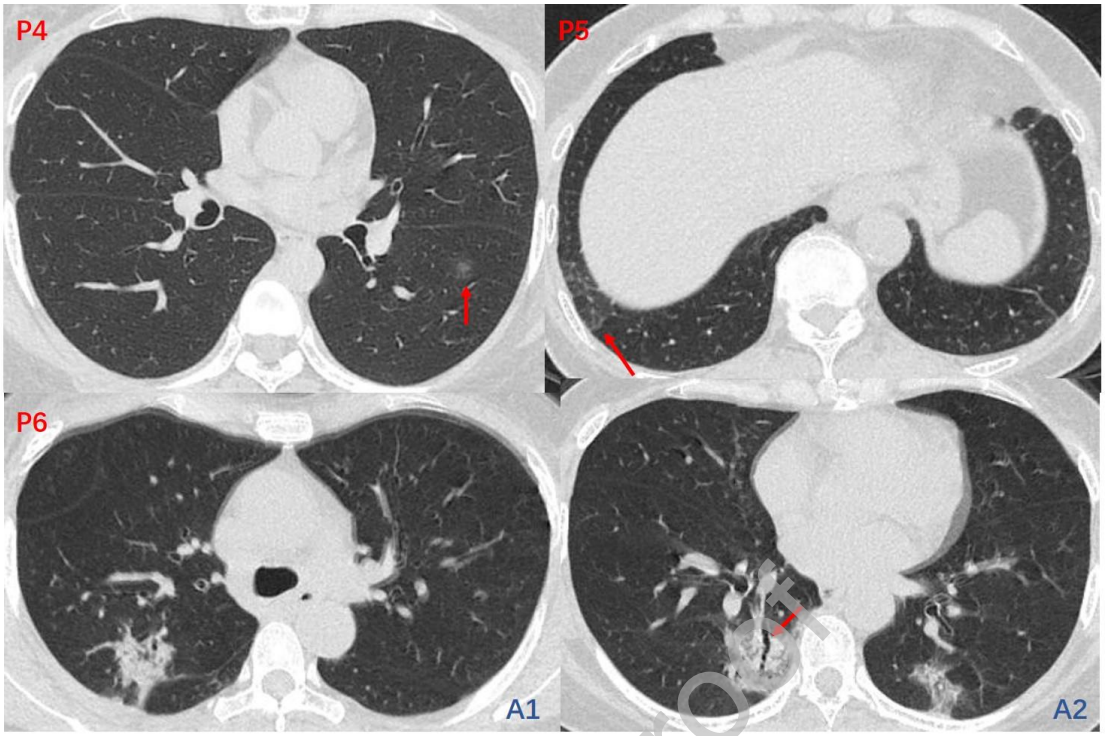

Figure 3 The initial CT images of P4, P5 and P6 (P6, A1-A2). CT images of P4 showed a small nodular-like pure GGO (P4, arrow) located in the central area of the left lower lobe. CT images of P5 showed a slight of irregular pure GGO (P5, arrow) located in the subpleural region of the right lower lobe. CT images of P6 showed bilateral multi-focal mixed GGO and consolidation in the subpleural area of lung. Mild bronchiectasis (P6, A2, arrow) can also be observed within the lesion.

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Table 1 Clinical characteristics of the 6 patients infected with SARS-CoV-2.

Clinical features	**P1**		**P2**	**P3**	**P4**	**P5**	**P6**
Gender	F		F	F	F	F	F
Age, years	27		32	56	32	63	54
Epidemiology	Went to Wuhan 17 days ago		Went to Wuhan 12 days ago	Went to Hubei 1 day ago	Went to Hubei 1 day ago	Went to Wuhan 2 days ago	No clear history related to Wuhan
SARS-CoV-2 RNA test results of oropharyngeal swabs	The second test was positive		Two tests were positive	The first test was positive	The second test was positive	Two tests were positive	The first test was positive
Chief complaint	Fever (38°)		Fever for 1 day (38°)	Fatigue and fever for 1 day (38°)	Fever 1 hour (38°)	Fever (38°)	Fever (40°)
Blood sample receiving date	1/31/2020	2/4/2020	1/31/2020	1/31/2020	1/25/2020	1/24/2020	2/5/2020
CRP, mg/L, 0.00-10.00	5.78	8.88	1.47	6.4	1.6	2.85	63.79
WBC#, x10^9/L, 4.00-10.00	3.77	4.57	3.40	5.69	6.87	4.08	5.89
NEUT#, x10^9/L, 1.80-6.40	2.55	2.68	2.22	3.45	5.30	3.13	4.15
LY#, x10^9/L, 1.00-3.30	0.98	1.44	0.80	1.42	1.01	0.55	1.31
EO#, x10^9/L, 0.05-0.50	0.01	0.00	0.01	0.20	0.12	0.01	0.01

Abbreviations: CRP, C-reactive protein; WBC, white blood cells; NEUT, neutrophil; LY, lymphocyte; EO, eosinophil; #: cell count. Note: The normal reference value range is listed

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behind the blood test index.

Table 2 Imaging characteristics during the first visit.

Imaging characteristics	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**
CT check of first visit (date)	01/31/2020	01/31/2020	01/25/2020	01/25/2020	01/24/2020	02/05/2020
Lobar location						
RUL						√
RML	√	√				
RLL	√	√			√	√
LUL			√			
LLL				√		√
Distribution						
Subpleural predominant	√	√			√	√
Perihilar						
Central			√	√		
Morphology						
Patchy-like	√	√			√	√
Nodular-like			√	√		
Attenuation						
GGO only	√		√	√	√	
Mixed GGO and consolidation		√				√
Consolidation only						
Other signs						
Reticulation						√
crazy paving	√					
Cavitation						

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Bronchiectasis	√
Pleural effusion	
Lymphadenopathy	

Abbreviations: RUL-right upper lobe, RML-right middle lobe; RLL-right lower lobe, LUL-left upper lobe, LLL-left lower lobe; GGO, ground glass opacity. Note: Check mark (√) indicate the appearance of the corresponding sign.

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