Case Report

CT imaging of the COVID-19

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COVID-19 pneumonia presented with certain characteristic chest CT imaging features, which are helpful to the radiologist in the early detection and diagnosis of this emerging global health emergency. In this report, we present chest CT findings from five patients with COVID-19. Except for one case with normal lung appearance, all the other four cases had certain characteristics, including ground-glass opacity (GGO), consolidation and atoll sign. The lesions were mainly distributed in the peripheral portion of lung.

Introduction

A novel coronavirus has resulted in an outbreak of viral pneumonia in December 2019 in Wuhan City, China.[1] We report five cases of the chest computed tomography (CT) findings of the coronavirus disease 2019 (COVID-19), all of them were positive on the real-time reverse transcription polymerase chain reaction (PCR) assay by throat swab. After diagnosis, these patients were immediately sent to the designated hospital for isolation and further treatment. Their laboratory tests are shown below (Table 1).

Case report

Case 1. A 30-year-old woman, presented for a car accident. She lives in Wuhan and had a car accident on her way to Taiyuan on the January 22, 2020. She coughed for two days. Her temperature is normal. Chest CT (Fig. 1 a) showed subpleural ground glass opacity(GGO) in the anterior segment of the left upper lobe and pendant changes on the dorsal side of both lungs. Thin layer CT display blood vessels thickened in the lesion (Fig. 1 b).

Case 2. A 21-year-old woman, take the same car with case 1 from Wuhan to Taiyuan. She had fracture of humerus due to car accident, no fever or cough. Chest CT is normal (Fig. 2).

Case 3. A 41-year-old man, with a travel history within a week to Xiaogan, China, another city next to wuhan where

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Table 1   Summary of Laboratory Examination Results of the patients with Coronavirus Disease 2019.

|	Reference range	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
White blood cell count, $\times 10^9$/L	3.5—9.5	12.5	5.0	4.3	4.0	4.2
Lymphocyte, $\times 10^9$/L	1.1—3.2	0.94	1.97	1.26	1.05	1.21
Lymphocyte ratio,%	20—50	7.5	21.3	29.0	26.0	28.7
Eosinophils, $\times 10^9$/L	0.02—0.52	0	0	0	0	0
Eosinophilratios,%	0.4—8	0	0	0	0	0
Neutrophils, $\times 10^9$/L	1.8—6.3	10.83	3.58	2.66	2.68	2.81
Neutrophilratios,%	40—75	86.8	51.2	61.4	66.4	66.8
C-reaction protein,mg/L	0—5	18.23	6.37	14.63	96.78	30.55
Procalcitonin,ng/ml	0—0.052	0.064	0.048	0.077	0.248	0.089
Erythrocyte sedimentation rate,mm/h	0—20	15	13	6	32	30
Creatinine,μmol/L	41—73	47.8	52.5	37.6	60.4	77
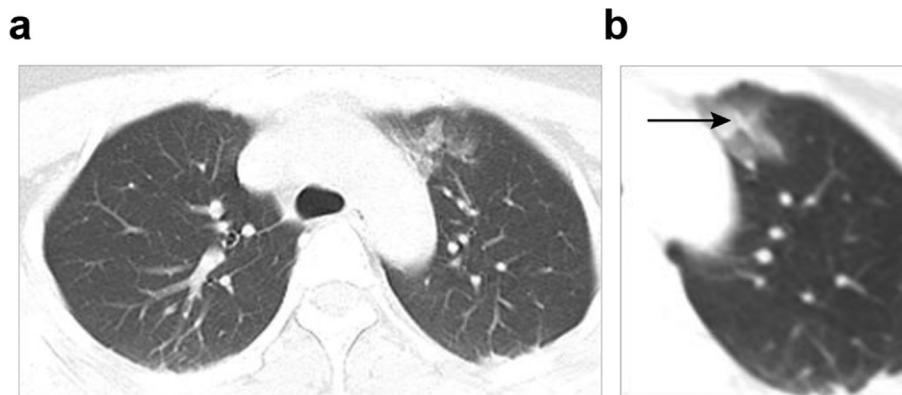
Figure 1   Images in a 30-year-old woman. a, Image shows subpleural GGO in the anterior segment of the left upper lobe. Pendant changes on the dorsal side of both lungs can be seen due to trauma and bedridden. b, 0.625 mm layer thickness display blood vessels in the lesion thickened (↑).

the COVID-19 was spreading also, presented for fever (38 °C) for two days. Chest CT (Fig. 3) showed consolidation and bronchiectasis in the lesion.

Case 4. A 40-year-old woman, wife of Case 3, returned to Taiyuan from Xiaogan together with Case 3, was admitted to the emergency department due to fever (38.5 °C), fatigue and cough for two days, with little yellow phlegm, no

sweating. Chest CT (Fig S1 a,b) showed sub-pleural fine mesh shadow in GGOs in both lungs,[2,3] The long axis of the lesion is parallel to the pleural surface.

Case 5. A 66-year-old woman, presented with cough for ten days, with little sputum, and the temperature was 37.7 °C. She lives in the same building with another patient diagnosed as COVID-19. They don't know each other, but share
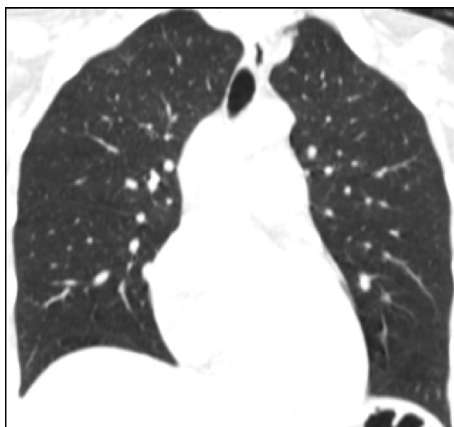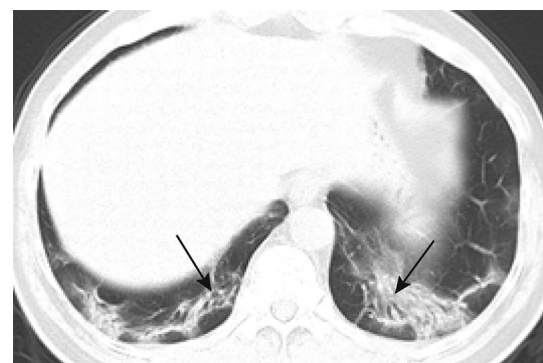

Figure 2   The chest CT is normal.

Figure 3   Image in a 41-year-old man. Subplural consolidation and fibrous shadow in both lower lobes. Bronchiectasis can be seen in the lesions (↑).

an elevator. Chest CT (Fig S2a) showed sub-pleural fine mesh shadow in GGO in both lower lobes and bronchiectasis in the consolidation of right lower lobe. Sagital reconstruction shows multiple atoll sign (Fig S2b).

Discussion

Four of the five patients have an exposure to the epidemic area, but Case 5 only lives in the same building with a confirmed patient, and an elevator is shared. It is suggested that COVID-19 is highly contagious, and sharing elevator is also a way of transmission, in addition to the known routes of transmission.

In Case 2, the PCR test was positive but the chest CT was normal on the same day. There were also PCR negative but CT positive cases reported.[4] So, a combination of swab tests and CT scanning may be helpful for individuals with high clinical suspicion of COVID-19 to reduce missed diagnosis.

In all of the four cases except Case 2, ground glass opacities (GGO) was the main radiological demonstration distributed in the peripheral or sub-pleural area, either unilateral or bilateral lungs, which is the typical performance according to previous radiographic studies reported.[5] In Case 1, there was only sub-pleural GGO, which involved one segment of one lobe of the lung, indicating that the disease was in its early stage.[6] Incase 3 and 4, there were GGO, consolidation and fibrous strand at the same time, which may indicate that the infection rapidly aggravated and the disease was in its progressive stage.[6] Atoll sign can be seen in Case 5, which has not been reported in previous COVID-19 cases. It shows a low-density shadow in the center, surrounded by increased density GGO ring. The diagnostic value of this sign in COVID-19 needs to be studied in a large number of cases. Notably, lung cavitation, discrete pulmonary nodules, pleural effusions, and lymphadenopathy were absent in all of these five patients on CT.

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Declaration of Competing Interest

All authors declare that they have no any conflict of interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jfma.2020.04.006.

References

1. Organization WH. *WHO/Novel coronavirus—China.* Switzerland: World Health Organization; 2020.
2. Lei J, Li J, Li X, Qi X. CT imaging of the 2019 novel coronavirus (2019-nCoV) pneumonia. *Radiology* 2020;**295**:18.
3. Kanne JP. Chest CT findings in 2019 novel coronavirus (2019-nCoV) infections from wuhan, China: key points for the radiologist. *Radiology* 2020;**295**:16—7.
4. Huang P, Liu T, Huang L, Liu H, Lei M, Xu W, et al. Use of chest CT in combination with negative RT-PCR assay for the 2019 novel coronavirus but high clinical suspicion. *Radiology* 2020:200330.
5. Liu P, Tan XZ. 2019 Novel Coronavirus (2019-nCoV) Pneumonia. *Radiology* 2020;**295**:19. https://doi.org/10.1148/radiol.2020200257.
6. Pan F, Ye T, Sun P, Gui S, Liang B, Li L, et al. Time course of lung changes on chest CT during recovery from 2019 novel coronavirus (COVID-19) pneumonia. *Radiology* 2020 Feb;**13**:200370. https://doi.org/10.1148/radiol.2020200370 [Epub ahead of print].