CT Manifestations and Clinical Features of the 2019 Novel Coronavirus Pneumonia Infected by Cluster Transmission Within a Family: Case Report

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Abstract

Background: In December 2019, a cluster of patients associated with a seafood wholesale market was confirmed having infected the 2019 novel coronavirus (2019-nCoV) in Wuhan, China. As of Feb 11, 2020, 43144 cases of the 2019-nCoV infection have been confirmed in the world, and person-to-person transmission has been recognized. To our knowledge, there are no reports regarding the 2019-nCoV pneumonia infected by cluster transmission within a family. The amount of close contact suspect was increasing. We reported cases of family cluster transmission of the 2019-nCoV infection, showing the differences in computed tomography (CT) manifestations and symptoms between patients with and without history of exposure to the epidemic area (Wuhan).

Case Presentation: A 48-year-old man was presented to the hospital in Jan 30, 2020 with a 2-day history of low fever and chill. He had traveled to Wuhan City of Hubei Province of China 12 days before, and was confirmed having the 2019-nCoV infection based on his positive CT manifestations, clinical signs, and real-time fluorescence polymerase chain reaction results. The other three members of his family without history of exposure to the epidemic area (Wuhan) were subsequently identified having the 2019-nCoV transmissive infection based on the positive findings of real-time fluorescence polymerase chain reaction, but they did not have abnormal CT manifestations and clinical signs.

Conclusion: For patients who have history of exposure to the epidemic area (Wuhan), the 2019-nCoV infected pneumonia can be identified by real-time fluorescence polymerase chain reaction testing and chest CT together with the symptoms. But for patients without exposure to the epidemic area, the 2019-nCoV infection can be confirmed by real-time fluorescence polymerase chain reaction testing and history of close contact with confirmed patients who have history of exposure to the epidemic area.

Background

Dec 31, 2019, the Health Commission of Hubei province, China, first reported a cluster of patients with pneumonia related to an newly discovered virus which has been named "2019 Novel Coronavirus" (2019-nCoV), it was linked to a seafood wet animal wholesale market in Wuhan, Hubei Province, China.[1, 2] As of Feb 11, 2020, 43144 cases of the 2019-nCoV infection have been confirmed globally,[3] and person-to-person transmission has been confirmed.[4] The outbreak is still on-going, the amount of confirmed patients and close contact suspects is increasing.[3] To our knowledge, there are no reports regarding the 2019-nCoV pneumonia infected by cluster transmission within a family. The definite diagnosis of the 2019-nCoV transmissive infection is importance. To avoid continuously cross transmissive infection and ensure early effective treatment, we reported the diagnosis of the 2019-nCoV transmissive infection within a family cluster of four patients in Nanchong City of Sichuan Province of China, and one of them had a history of travel to Wuhan, the remained three family members did not travel to Wuhan before they had got the infection.

Case Presentation

Patient Demographics, Chief Complaint and Past History

A 48-year-old man (Patient 1) was presented to the hospital in Jan 30, 2020 with a 2-day history of low fever and chill. He did not have the symptoms of cough, dyspnea, sputum production, and myalgia or fatigue or headache. He traveled to Wuhan in Jan 15, 2020 for work needs, and came back to Nanchong City of Sichuan Province of China in Jan 18, 2020. He has got hypertension for 10 years, and denied diabetes mellitus, heart disease, or any respiratory ailment. He was not a consumer of tobacco, alcohol, or any known stimulants. He was not on any medication. There was no family history of any respiratory ailment. The

history was given by the patient himself. This patient underwent computed tomography (CT) and real-time fluorescence polymerase chain reaction examination, and was confirmed having the 2019-nCoV pneumonia.

The previous patient's other family members including his wife aged 39 year (Patient 2), his son aged 10 years (Patient 3), and his mother aged 68 years (Patient 4) were arranged to isolated observe due to close contact of the family members, and received real-time fluorescence polymerase chain reaction testing of each patient's throat swab and unenhenced chest CT. All Patient 1's other family had no clinical signs and symptoms.

Physical Examination and Diagnostic Assessment

As for Patient 1, his body temperature was elevated to 37.5 centigrade degree, the blood pressure was elevated to 148/83 mmHg, with 95 heart beats per minute and 21 breaths per minute, and without pallor, icterus, rash, or abnormal skin pigmentation. Laboratory testing showed the C-reactive protein was elevated to 18.32 mg/L (normal range <5 mg/L), and the count of white blood cell, neutrophil and lymphocyte was in normal range. As shown on chest CT, multiple ground-glass opacities were observed in both lungs. Ultimately, the positive (2019-nCoV)-ORF1ab and (2019-nCoV)-N of the patient's throat swab tested by real-time fluorescence polymerase chain reaction indicated that he was infected the 2019-nCoV.

As for Patients 2, 3 and 4, we found no abnormality on their CT images. Their laboratory testing showed the C-reactive protein, and count of white blood cell, neutrophil and lymphocyte in normal ranges. But the positive (2019-nCoV)-ORF1ab and (2019-nCoV)-N of the throat swab tested by real-time fluorescence polymerase chain reaction indicated that they were infected the 2019-nCoV.

CT Manifestations of Patient 1 and His Family Members

All the CT images of the four patients were observed through 1 millimeter thin section of

CT reconstruction. On the CT images of Patient 1 in Feb 4, 2020, we found multiple patchy ground-glass opacities with interlobular septal thickening and/or with small consolidation in all five lung lobes. The ground-glass opacities were mainly distributed close to pleura (Figure 1a and b). We did not found pleural effusion, pericardial effusion, lymphadenopathy and bronchus involved. And the CT images in Feb 8, 2020 showed that the scope of the ground-glass opacities and its consolidation were increasing (Figure 1c and d). We found no obvious abnormal CT findings in Patients 2, 3 and 4.

Discussion And Conclusion

Coronaviruses are widely distributed among humans, other mammals and birds, and have been identified to cause respiratory, hepatic, gastrointestinal and neurological infections.[5] The 2019-nCoV is an emerging disease outbreak with potentially far reaching public health ramifications.[6] Patients with confirmed 2019-nCoV infection have reported respiratory illness with fever, cough, and shortness of breath.[5] Real-time fluorescence polymerase chain reaction testing of the patient's throat swab, unenhenced chest CT manifestations and laboratory findings play important roles in diagnostic workup for patients with suspected infection.[4,7]

In our cases with the 2019-nCoV pneumonia infected by family cluster transmission, Patient 1 was confirmed by the results of real-time fluorescence polymerase chain reaction testing and CT together with his history and symptoms. However, we found no abnormality in CT images of Patient 1's other family members, but the positive (2019-nCoV)-ORF1ab and (2019-nCoV)-N genomic findings of each member's throat swab tested by real-time fluorescence polymerase chain reaction, indicating that they were infected the 2019-nCoV. We can speculate three probable causes for explaining the previous differences between Patient 1 and his other family members as follows. Firstly, the 2019-

nCoV infection of Patient 1's family members were in initial period, viruses could be still infected only the upper respiratory tract. Secondly, Patient 1 had the history of exposure to the epidemic area (Wuhan), but his family members were infected secondarily by transmission from his infection. We can speculate that the pathogenicity and proliferation rate of the 2019-nCoV may be related to the concentration of virus distribution in the environment and the amount of virus the patient inhaled. Thirdly, middle aged men are the most vulnerable to the 2019-nCoV as the study implied.[8] Also, our findings suggest that Patient 1 could be more vulnerable to the 2019-nCoV than his other family members, and Patient 1's other family members can present milder symptoms or have no symptoms. Meanwhile, the previous probable reasons maybe cause different progression of the 2019-nCoV infection in Patient 1 and his other family members, resulting in the obvious difference of CT manifestations between Patient 1 and his other family members. As for Patient 1's other family members, their 2019-nCoV infection can be confirmed by the positive results of real-time fluorescence polymerase chain reaction testing and history of close contact with patients with confirmed 2019-nCoV infected pneumonia.

In conclusion, the 2019-nCoV infected pneumonia can be identified by the positive findings of real-time fluorescence polymerase chain reaction testing and chest CT together with the symptoms and patient's history of exposure to the epidemic area (Wuhan). And the suspected patients without history of exposure to the epidemic area can be confirmed by the positive findings of real-time fluorescence polymerase chain reaction testing and history of close contact with confirmed patients despite no abnormality of CT manifestations and clinical symptoms. We hope that our report can be helpful for preventing continuous cross transmissive infection and early effective treatment.

List Of Abbreviations

1.   The 2019 novel coronavirus: 2019-nCoV

2.   Computed tomography: CT

Declarations

References

1.   Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. N Engl J Med. 2020 Jan 24. doi: 10.1056/NEJMoa2001017. [Epub ahead of print]

2.   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. Lancet 2020; 395(10223): 507-513.

3.   Zhao S, Lin Q, Ran J, Musa SS, Yang G, Wang W, et al. Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. Int J Infect Dis 2020; 92: 214-217.

4.   Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet 2020; 395(10223): 514-523.

5.   Carlos WG, Dela Cruz CS, Cao B, Pasnick S, Jamil S. Novel Wuhan (2019-nCoV) Coronavirus. Am J Respir Crit Care Med 2020; 201: P7-P8.

6.   Chung M, Bernheim A, Mei X, Zhang N, Huang M, Zeng X, et al. CT Imaging Features of 2019 Novel Coronavirus (2019-nCoV). Radiology. 2020 Feb 4: 200230. doi: 10.1148/radiol.2020200230. [Epub ahead of print]

7.   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. Lancet 2020; 395(10223): 497-506.

8.   Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. N Engl J Med. 2020 Jan 29. doi: 10.1056/NEJMoa2001316. [Epub ahead of print]

Figures
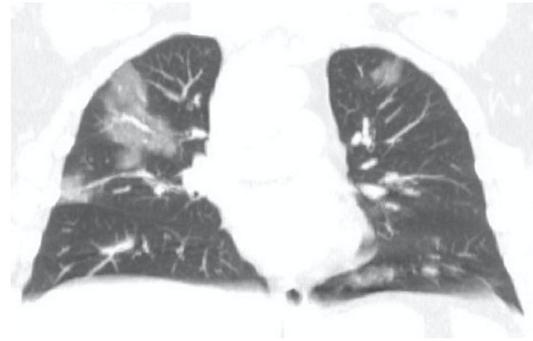
Figure 1

Multiple patchy ground-glass opacities with interlobular septal thickening and/or with small consolidation are shown in all five lung lobes in a male with the 2019 novel coronavirus infected pneumonia, and are mainly distributed close to pleura (a and b). Four days later, the density and scope of the previous lesions increase as shown on the follow-up CT (c and d).