Abstract: Clinical, laboratory, and computed tomography (CT) findings of 5 cases of the novel Coronavirus Disease 2019 (COVID-19) pneumonia from patients outside of Wuhan were reviewed. The human-to-human transmission of the virus may explain the infection of the disease outside of Wuhan. CT examination is important in the early detection and follow-up of the disease. With a history of exposure or travelling, symptoms of fever and cough, and the typical CT manifestation such as ground-glass opacity with a peripheral distribution, we should also think of the possibility of the COVID-19 pneumonia in patients outside of Wuhan.

Key Words: computed tomography, novel coronavirus pneumonia, diagnosis

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SARS-COV-2, newly named by the international committee on taxonomy of viruses, belongs to the family Coronaviridae and the order Nidovirales, a family that includes viruses causing diseases ranging from the common cold to Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS).1–3 On the same day, WHO named the disease caused by the novel coronavirus as Coronavirus Disease 2019 (COVID-19).4

Here we report 5 cases of the novel coronavirus pneumonia and demonstrate the common imaging features of the disease in order to help radiologists be equipped with early recognition of this disease.

CASE 1

A 45-year-old woman presented to the hospital with a 3-day history of fever, dyspnea, and cough. She indicated that she had a cruise tour to Japan 2 weeks before. At admission, her body temperature was 38.3°C, and coarse breath sounds of both lungs were heard at auscultation. Laboratory studies showed leukopenia (white blood cell count, 3.77×10^9/L) and lymphopenia (lymphocyte count, 0.901×10^9/L). The white blood cell differential count showed 69.2% neutrophils and 23.9% lymphocytes. Elevated C-reactive protein (32.73 mg/L, normal range, 0 to 10 mg/L) was detected. Real-time fluorescence polymerase chain reaction from the patients’ nasal and pharyngeal swab specimen was positive for the novel coronavirus (SARS-COV-2) nucleic acid. Unenhanced chest CT showed patchy peripheral ground-glass lesions in the right upper lobe (Fig. 1A).

The patient was treated with antiviral drugs (lopinavir-ritonavir) and supportive care. Two days later, the patient’s temperature was 36.7°C. Repeat CT scan showed partial resolution of the ground-glass opacities (GGOs) and new septal line thickening in both upper lungs. A new consolidation in the left upper lung was also discovered (Fig. 1B). The patient showed improvement under observation after administration of the antiviral drugs (lopinavir-ritonavir) and the anti-infection drug (levofloxacin).

CASE 2

A 62-year-old woman was admitted to our hospital with cough and sputum for 4 days. Her son-in-law came back to see her from Wuhan 11 days before she became ill. The patient had hypertension for 10 years. At admission, her body temperature was 37.3°C, and coarse breath sounds of both lungs were heard at auscultation. Laboratory studies showed normal complete blood count values and normal C-reactive protein. Real-time fluorescence polymerase chain reaction from the patients’ nasal and pharyngeal swab specimen was positive for the novel coronavirus (SARS-COV-2) nucleic acid. Unenhanced chest CT showed patchy peripheral ground-glass lesions in the right upper lobe (Fig. 2A).

The patient was treated with antiviral drugs (lopinavir-ritonavir) and supportive care. Two days later, the patient’s temperature was 37°C. Repeat CT scan showed progression of the original lesions (Fig. 2B).

CASE 3

A 59-year-old woman presented to the hospital with a 5-day history of fever, chills, and fatigue. She indicated that she had a long-distance flight from London to Chengdu 10 days before. At admission, her body temperature was 37.4°C, and coarse breath sounds of both lungs were heard at auscultation. Laboratory studies showed normal complete blood count values, but slight lymphopenia (lymphocyte 1.065×10^9/L), and elevated C-reactive protein (24.61 mg/L, normal range, 0 to 10 mg/L). Real-time fluorescence polymerase chain reaction from the patients’ nasal and pharyngeal swab specimen was positive for the novel coronavirus (SARS-COV-2) nucleic acid. Unenhanced chest CT showed patchy GGOs with some thickened interlobular septa in the right lower lobe (Fig. 3A).

The patient was treated with antiviral drugs (lopinavir-ritonavir) and supportive care. Two days later, the patients’ temperature rose to 38.2°C. A repeat CT scan showed partial resolution of the GGOs and new linear opacities in the right lower lobe (Fig. 3B).

CASES 4 AND 5

A 55-year-old man who presented with a 14-day history of cough and his wife, a 41-year-old, who presented with a 6-day history of cough and sputum, after a dinner with their friends from Wuhan 2 weeks before, were admitted to our hospital. At admission, both of them had normal body temperature 37.0°C, but coarse breath sounds of both lungs were heard at auscultation. Laboratory studies showed that both had normal complete blood count values but elevated C-reaction protein (69.93 mg/L for the man and 21.27 mg/L for the woman, normal range, 0 to 10 mg/L). Real-time fluorescence polymerase chain reaction carried out for the patients’ nasal and pharyngeal swab specimens were positive for the novel coronavirus (SARS-COV-2) nucleic acid. Unenhanced chest CT showed multiple...
FIGURE 1. A, CT image showed the typical “crazy paving” pattern in both upper lungs. B, CT image showed partial resolution of the ground-glass opacities and new septal line thickening in both upper lungs. Note the presence of consolidation in the left upper lung.

FIGURE 2. A, CT image showed patchy GGO in the right upper lung. B, CT image showed enlargement of the GGOs in the right upper lung.

FIGURE 3. A, CT image showed the GGO in the right lower lung. B, CT image showed the resolution of the GGO and new septal line thickening.
bilateral areas of peripheral GGOs for the man (Fig. 4) and multiple GGOs with a rounded morphology in both lungs for the woman (Fig. 5). The woman had a repeat CT scan 2 days later and showed decreased number of the GGOs. The 2 patients were transferred to another hospital with antiviral drugs (lopinavir-ritonavir) and supportive care.

DISCUSSION

The World Health Organization declared the China coronavirus as a global health concern on January 30, 2020. On February 28, there have been a total of 78,959 confirmed cases of the novel Coronavirus Disease 2019 (COVID-19) pneumonia, and an additional 2308 suspected cases have been reported in China, with 2791 deaths.

According to a recent report from China, most patients of the novel coronavirus pneumonia had a history of contact with livestock, recent travel to Wuhan, and contact with people from Wuhan, but still 26.0% of patients outside of Wuhan did not have a recent travel to Wuhan or contact with people from Wuhan. In our 5 cases of the novel coronavirus pneumonia, 2 patients were affected from a family cluster, 1 patient had contact with people from Wuhan, and the other 2 patients had long-distance travelling or flight. These findings also verified the human-to-human transmission of the virus, as none of our patients had a direct contact with livestock. The patients probably were infected from asymptomatic individuals.

The most common symptoms of the disease are fever and cough, which were also found in our patients. Underlying disorder (ie, hypertension, chronic obstructive pulmonary disease) were more common in severe cases. And, among our cases, only 1 patient had comorbidity of hypertension.

For laboratory findings at presentation, elevated levels of C-reactive protein were demonstrated in most patients, and lymphopenia, thrombocytopenia, and leukopenia can also be found in severe cases. In our 5 cases, 4 patients had elevated levels of C-reactive protein, and 1 patient had both leukopenia and lymphopenia.

Chest CT is an important modality in the early diagnosis of the novel coronavirus pneumonia for patients with suspected infection. GGOs and consolidation are the main CT findings followed by opacities with a rounded morphology, reticulation, and crazy paving. The lesions also had a peripheral predominance from the previous report. GGO are the most common finding in our patients, and one patient manifested the typical crazy-paving pattern, which is described as thickened interlobular septa and intralobular lines with superimposed GGO. The lesions in our cases also had a peripheral distribution.

Follow-up chest CT is important for the evaluation of the progression of the disease, as it may change fast within a few days. Coexistence of GGO, consolidation, and septal line thickening is the main manifestation in the progression of the disease. The second CT showed progression in 7 of 8 patients in a previous report with increasing number of opacities and density of consolidation. In our cases, 4 patients had a follow-up chest CT 2 days after admission. Three cases demonstrated new lesions of consolidation and septal line thickening or expansion of the lesions of GGO, and only 1 patient showed improvement from CT images.

The CT findings of the COVID-19 pneumonia are similar to Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS). However, multifocal involvement was more common in the COVID-19 pneumonia, while unifocal lung involvement was more common in SARS. A basilar and subpleural airspace and extensive GGO are more common in MERS, which were less typical of the COVID-19 pneumonia.

In conclusion, given a history of exposure or travelling, symptoms of fever and cough, and the typical CT manifestation like GGO with a peripheral distribution, the radiologists should also be vigilant about the possibility of the COVID-19 pneumonia for patients from cities other than Wuhan.

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