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Case Report

A fatal outcome from SARS-CoV-2 infection: One case report of a young man with multiple organ damage

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Abstract

The coronavirus disease 2019 (COVID-19) first emerged in Wuhan, China on December 2019 and has become a severe public health issue worldwide. A 36-year-old man was presented to the hospital staff with a fever that had already persisted for a three-day period, general weakness and diarrhea. He had no chronic diseases and was tested positive for COVID-19 with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) nucleic acid. During his hospitalization, several abnormal indicators appeared in his laboratory tests, which implied systemic inflammation and multiple organ damage. A series of chest radiographs monitored the dynamic process of lung lesions, which could predict the clinical changes of the patient. His condition deteriorated rapidly, resulting in death due to acute respiratory distress syndrome (ARDS) on hospital day 13. The case indicates that inflammatory response may appear in people infected with SARS-CoV-2 and may lead to multiple organ damage (especially pancreatic damage). When a COVID-19 patient is entering into the critical stage, their condition could rapidly deteriorate.

Keywords: COVID-19; Radiological manifestation; Inflammatory response; Multiple organ damage

1. Introduction

Starting in late December 2019, coronavirus disease 2019 (COVID-19) broke out rapidly in Wuhan, China, and the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has aggressively spread around the world. As of 26 March 2020, the World Health Organization had reported 462,684 SARS-CoV-2 infection cases and 20,834 deaths globally [1]. It was reported that young people without underlying conditions usually express mild symptoms and have a good prognosis, whereas elderly people and those with chronic illnesses are more susceptible to SARS-CoV-2 [2,3]. Some severe cases have resulted in patients experiencing rapid deterioration and even dying [3]. In this report, we outline the case of a young man without underlying conditions who had died from ARDS on his 13th day in the hospital.

2. Case presentation

A 36-year-old man was admitted to the fever clinic expressing a high fever of 40.0 °C on the morning of 9 January 2020. His symptoms included fever, weakness and diarrhea that had persisted for three days prior to arriving at the hospital. According to the patient's statement, he was a nonsmoker. His medical record included no past chronic diseases, and he had never been to the Huanan seafood wholesale market. A chest computed tomography (CT) was performed

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and indicated that there were multiple patchy ground-glass opacities in his bilateral lungs and consolidation in the posterior segment of the right upper lobe (Fig. 1). Laboratory studies showed leukocytosis (white blood cell count: 10.26×10^9/L), and the white blood cell differential count showed 83.1% neutrophils and 10.7% lymphocytes. There were elevated blood levels for high-sensitivity C-reactive protein (119.76 mg/L) and procalcitonin (1.85 ng/mL). Moreover, there were multiple clinical indexes that exceeded the normal range, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatine kinase (CK), creatine kinase-MB (CK-MB), lactate dehydrogenase (LDH), creatinine (Cr) and blood glucose (Table 1). It is worth noting that his blood glucose level at the time of his admission was 20.4 mmol/L, which far exceeded the normal range. Influenza virus (A, B, H7 subtype avian influenza) antigen test of his throat swab was negative.

On his second day at the hospital, he had a slight dry cough. Antibody detection of eight respiratory pathogens was performed, which showed that IgM antibody of Influenza Virus A was positive and the remaining seven pathogens were negative, including respiratory syncytial virus, adenovirus, influenza virus B, parainfluenza virus, legionella pneumophila, chlamydia pneumoniae and mycoplasma pneumoniae. Considering the current epidemic of unexplained pneumonia in Wuhan and the persistent high fever of the patient, he was treated with active monitoring. During that time, the patient received anti-infection therapy with biapenem and moxifloxacin, oseltamivir capsule for antiviral, liver protection and other supportive treatments.

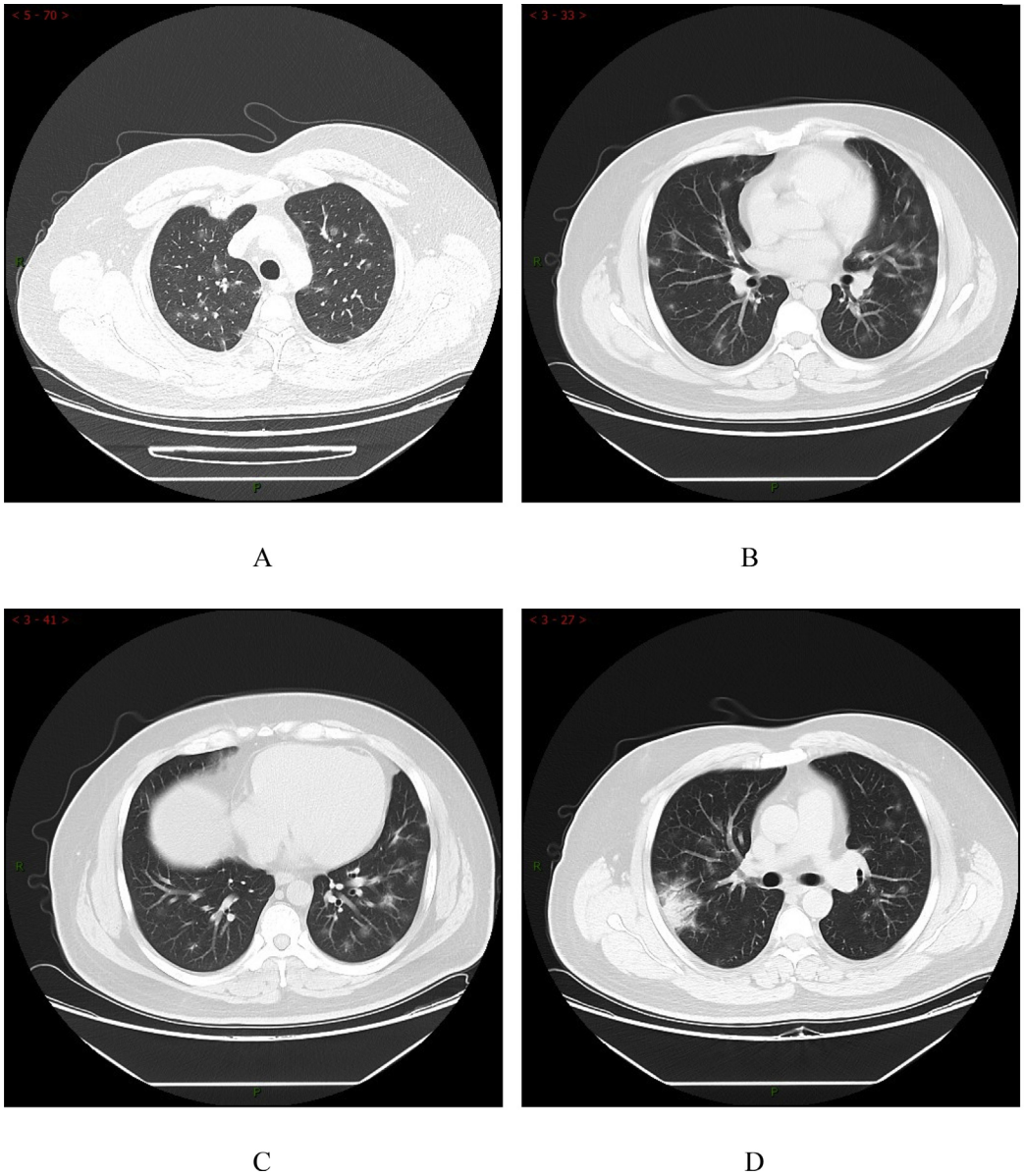

Fig. 1. Chest CT on January 9th, 2020. A-C, Images showed multiple ground-glass opacities at bilateral lungs; D, consolidation lesions could be seen in the posterior segment of the right upper lobe.

Table 1
Summary of laboratory results of the patient infected with COVID-19.

Items	At admission	1st review	2nd review	3rd review	4th review
White blood cell count ($\times10^9$cells/L); (normal range 3.5–9.5)	10.26 (↑)	9.11	11.59 (↑)	11.4 (↑)	15.21 (↑)
Neutrophil count ($\times10^9$cells/L); (normal range 1.8–6.3)	8.52 (↑)	7.95 (↑)	10.11 (↑)	10.27 (↑)	13.73 (↑)
Neutrophil percentage (%); (normal range 40–75)	83.1 (↑)	87.3 (↑)	87.2 (↑)	89.9 (↑)	90.3 (↑)
Lymphocyte count ($\times10^9$ cells/L); (normal range 1.1–3.2)	1.1	0.77 (↓)	0.68 (↓)	0.73 (↓)	0.84 (↓)
Lymphocyte percentage (%); (normal range 20–50)	10.7 (↓)	8.5 (↓)	5.8 (↓)	6.4 (↓)	5.6 (↓)
Eosinophil count ($\times10^9$cells/L); (normal range 0.02–0.52)	0 (↓)	0 (↓)	0 (↓)	0 (↓)	0 (↓)
Eosinophil percentage (%); (normal range 0.4–8)	0 (↓)	0 (↓)	0 (↓)	0 (↓)	0 (↓)
Hemoglobin (g/L); (male normal range 130–175)	150	144	144.6	117.4 (↓)	126.7 (↓)
Total protein (g/L); (normal range 65–85)	67.6	66.7	65.4	ND	60.3 (↓)
Albumin (g/L); (normal range 40–55)	39.4 (↓)	34.6 (↓)	31.8 (↓)	ND	29.9 (↓)
Globulin (g/L); (normal range 20–30)	28.2	32.1 (↑)	33.6 (↑)	ND	30.4 (↑)
Albumin/globulin; (normal range 1.5-2.5)	1.4 (↓)	1.08 (↓)	0.95 (↓)	ND	0.98 (↓)
Glucose (mmol/L); (normal range 3.9–6.1)	20.4 (↑)	16.18 (↑)	11.02 (↑)	ND	ND
Alanine aminotransferase (U/L); (normal range 9.0–50.0)	72 (↑)	46	42	ND	32
Aspartate aminotransferase (U/L); (normal range 15.0–40.0)	78 (↑)	48 (↑)	45 (↑)	ND	85 (↑)
Creatine Kinase (U/L); (normal range 0.0–171.0)	1218 (↑)	158	ND	ND	ND
Creatine Kinase isoenzyme (U/L); (normal range 0.0–25.0)	38 (↑)	29m	ND	ND	ND
Lactate dehydrogenase (U/L); (normal range 110.0–245.0)	291 (↑)	604m	ND	ND	ND
Blood urea nitrogen (mmol/L); (normal range 2.8–7.6)	4.59	5.24	5.83	ND	8.72 (↑)
Creatinine (μmol/L); (normal range 64–104)	107.3 (↑)	101.2	78.3	ND	66.4
High-sensitivity C-reactive protein (mg/L); (normal range 0.0–3.0)	119.76 (↑)	136.3 (↑)	ND	ND	ND
Procalcitonin (ng/ml); (normal range 0.0–0.05)	1.85 (↑)	0.39 (↑)	0.21 (↑)	0.09 (↑)	0.20 (↑)
Erythrocyte sedimentation rate (mm/h); (male normal range 0–15)	ND	ND	ND	32 (↑)	ND
D-dimer (ng/mL); (normal range 0–500)	87	160	477	625 (↑)	993 (↑)

ND, not detected; (↑), above normal range; (↓) below normal range. At admisssion, January 9; 1st review, around January 12; 2nd review, around January 14; 3rd review, around January 17; 4th review around January 19.

On day four, he suddenly felt chest tightness, shortness of breath, and difficulty breathing; he was transferred to the intensive care unit (ICU) due to respiratory failure (blood oxygen saturation was 76% under high oxygen flow stage). A chest digital radiography (DR) showed multiple large-scale consolidation images in both lungs (Fig. 2A). The patient was clinically worse in terms of the progressive lymphopaenia and inflammatory index. Auscultation of both lungs revealed obvious wheezing and moist rale. As his condition worsened, he required ventilatory and tracheal intubation support with synchronized intermittent mandatory ventilation (SIMV) mode, 40% fraction of inspiration O_2 (FiO_2) and 100% blood oxygen saturation (SpO_2). At that time, under repeated questions from the doctor, his family members revealed that they concealed the medical history that he had been to the Huanan seafood wholesale market on December 12 and 13, 2019. Combing the epidemiological characteristics, clinical symptoms and his progressed radiographic images, doctors suspected that he was a COVID-19 patient. He was immediately isolated for clinical monitoring, and throat-swab sputum real-time reverse-transcriptase polymerase-chain-reaction (RT-PCR) assay was detected simultaneously. COVID-19 was confirmed by RT-PCR, and 7 nucleic acid tests (influenza virus A, B, respiratory syncytial virus, adenovirus, parainfluenza virus, chlamydia pneumoniae and mycoplasma pneumoniae) showed negative on Jan 13, 2020.

From the 5th to 8th day of his hospitalization, the patient's body temperature remained at a relatively low level, and his oxygen saturation kept relatively stable under tracheal intubation. Bedside chest radiographs were made on day five and six, and was determined to have more slightly absorbed consolidation legions on the 6th day than that of the previous day (Fig. 2B–C). On day five, his blood pressure dropped to 92/50 mmHg, and an echocardiography confirmed poor systole function. His blood glucose tests conducted on January 12 and 14 showed 16.18 mmol/L and 11.02 mmol/L respectively. Consecutive 3 blood glucose measurements were significantly higher than normal. He was diagnosed with refractory hyperglycemia and treated with insulin after consulting the endocrinologist on January 14. Blood tests showed a persistent increase in neutrophil proportion and a decrease in his lymphocyte ratio. Anti-inflammatory strategies were adjusted to duffy, tainen, swo and methylprednisolone on day eight. On day nine, the patient's body temperature rose to 38.9 °C again, and his oxygenation was poor, despite the tracheal intubation connected to the ventilator. Thus, adjusting the ventilator parameters to increase the oxygen concentration was required. However, the bedside chest radiograph done on the same day showed that most of the consolidation lesions were absorbed (Fig. 2D).

The patient continued to have a high fever for the next few days. Laboratory tests showed a high level of inflammatory indicators, aspartate aminotransferase, blood urea nitrogen and D-dimer on day 11. From that day onward, the patient's condition deteriorated sharply. It was difficult to maintain oxygenation through mechanical ventilation. Meanwhile, chest radiograph showed massive consolidation appeared in bilateral lungs (Fig. 2E) on his 12th day in the hospital. Extracorporeal membrane oxygenation (ECMO) was performed on hospital

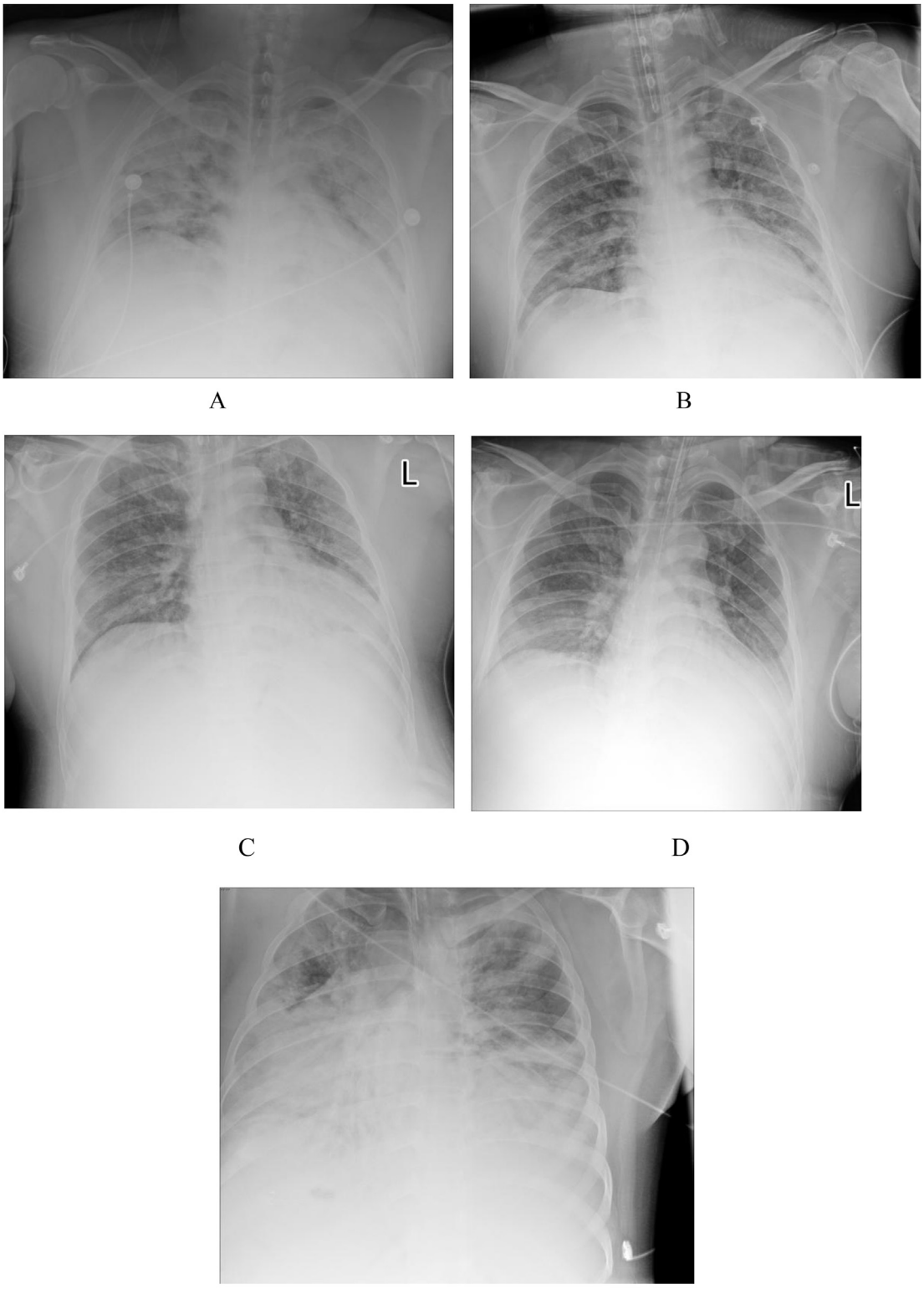

Fig. 2. A series of bedside chest radiographs of the patient. A, On hospital day four, multiple patchy consolidation lesions appeared in bilateral lungs; B, On hospital day five, consolidation lesions partially absorbed than the previous day; C, On hospital day six, consolidation lesions slightly absorbed than the previous day; D, On hospital day nine, most of the consolidation lesions were absorbed; E, On hospital day 12, multiple consolidation lesions suddenly appeared in bilateral lungs.

day 13 to support oxygen supply. Despite the medical staff's best efforts, the patient eventually died of ARDS.

3. Discussion and conclusions

Our report discussed a COVID-19 case that occurred in a young man without underlying conditions. The patient had an epidemiological history of visiting a seafood and wet animal wholesale market in Wuhan, China. He had the typical symptomatic features of COVID-19 with fever, dry cough, weakness and enteric symptoms. The patient was diagnosed with the COVID-19 pneumonia based on the diseases typical expression, the patient's epidemiological history, rapid progressing imaging features and positive nucleic acid test of SARS-CoV-2. There is no doubt that the patient infected with SARS-CoV-2 for his positive RT-PCR nucleic acid test, and positive IgM antibody of influenza virus A may attribute to contamination during sampling or combined influenza virus A infection.

During his clinical course, the body temperature was at a stage of high fever for most of patient's time in the hospital. There were elevated blood levels for inflammatory factors including high-sensitivity C-reactive protein, procalcitonin, erythrocyte sedimentation rate and D-dimer. Various inflammatory indicators and white blood cell count were mostly above the normal range during his hospitalization. The elevation of these factors represented a systemic inflammatory response and may be associated with the death of this young man. It has been reported that an inflammatory response is an important factor in the death of such patients [4]. The cytokine storm could be caused by many factors and presented with different symptoms, as such we still need to learn more about this chain action.

Besides lung injury, the inflammatory response also showed multiple organ damage, including the liver, heart and kidney. That can be confirmed by the abnormal laboratory results (albumin/globulin index, ALT, AST, CK, CK-MB, LDH, Cr and blood urea nitrogen) and the blood pressure decrease of the patient. For this case, however, the reason why his blood glucose level continued to be so high (far exceeded the normal range) remains unclear. We considered the inflammatory response to be the cause behind the damage of the pancreas and the refractory hyperglycemia. However, further studies are needed due to a reduced response of refractory hyperglycemia.

Both the clinical procedure and radiological features progressed rapidly in this patient. Imaging changes could reflect the clinical progress of the patient. According to a recent study, the sensitivity of chest CT in suggesting COVID-19 was 97% (580/601 patients) [5]. The change of lesions in CT images is closely associated with the disease process [6,7]. A series of radiographic images helped us to assess the patient's condition from an imageology perspective. Clinical and radiographic courses roughly kept in the same step, or the imaging performance was done later than the clinical appearance in the patient's critical period.

COVID-19 may progress to be a pandemic associated with substantial morbidity and mortality. It can be transmitted by people who are just mildly ill or even asymptomatic. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team of China reported that the virus can lead to the death of healthy adults in addition to elderly people with existing health problems, and it has a case fatality risk of around 1% [8], which is in line with the case we reported.

In conclusion, the experience in this case showed that young patients with no underlying conditions can also express rapid deterioration and even die, which requires our determined clinical observation on the patient's conditions. Patients infected with SARS-CoV-2 could develop inflammatory responses and experience multiple organ dysfunction, especially pancreatic damage, thus requiring further studies. Radiological images could predict the clinical changes of the patient with COVID-19 simultaneously but with a delay in the critical period.

Ethical statement

Not applicable.

Availability of data and materials

All data and materials are available with the first author.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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Not applicable.

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