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A 106-year-old patient with unexpected COVID-19 pneumonia: A case report

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Abstract

The fast spread of COVID-19, which was caused by SARS-CoV-2 infection, has posed a major challenge to public health systems around the world. Morbidity and mortality are higher in the elderly than in the young, due to a loss in immune function and more comorbidities. In this case, we describe a 106-year-old female patient, the oldest COVID-19 patient since 2019, who had not previously received the SARS-CoV-2 vaccine. Her clinical symptoms included cough and sputum production. Images of her chest CT showed double lung pneumonia, and laboratory tests revealed elevated serum KL-6 levels. She was mostly on oral medication during her hospitalization and recovered well. With the case, we discuss the risk factors and biomarkers correlated to COVID-19 severity. Following the COVID outbreak, it's vital to explore the possible risk factors that can help with disease risk stratification, identifying high-risk individuals, developing precise treatment regimens, and lowering mortality rates.

CASE REPORT

INTRODUCTION

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has been spreading fast over the world since December 2019, producing the Coronavirus Disease 2019 (COVID-19) pandemic. By invading alveolar epithelial cells and vascular endothelial cells, SARS-CoV-2 disrupts the integrity of the epithelial-endothelial barrier, leading to increased vascular permeability, exacerbating inflammatory responses, and triggering pulmonary edema (Wiersinga *et al.* 2020). Asymptomatic, respiratory, and non-respiratory symptoms, acute respiratory distress syndrome (ARDS), and multi-organ failure are all possible clinical manifestations of SARS-CoV-2 infection. The COVID-19 pandemic's broad spread has significantly influenced worldwide public health systems and constitutes a major threat to human health.

The elderly were much more vulnerable to the COVID-19 pandemic because of the increasing weakening of the immunological function with age and a lower ability to defend against SARS-CoV-2 infection. Moreover, comorbidities such as hypertension, diabetes, and cardiovascular disease are more common among older adults. These risk factors often lead to rapid deterioration and adverse outcomes, as a result, the risk of COVID-19 infection, severe illness, and mortality are increased in the elderly. Looking into the relevant risk factors can provide evidence for risk stratification, which contributes to the rational allocation of health care resources and the reduction of mortality, so it is important to pay special attention to these risk factors (Wang *et al.* 2020). This case report describes the oldest patient to date since 2019, a 106-year-old female patient,

through which we can discover certain risk factors relevant to COVID-19 severity.

CASE REPORT

On April 15, 2022, a confirmed case was reported in a nursing home, and close contacts of the confirmed case were then tested for SARS-CoV-2 using real-time reverse transcriptase-polymerase chain reaction (rRT-PCR). A 106-year-old woman presented with a positive rRT-PCR and received inpatient treatment. The female patient had hypertension but was in a good physiological and psychological condition with a high degree of autonomy before admission and had not been vaccinated against coronavirus disease. Shortly after hospitalization, she developed a cough and sputum production, but never had a fever.

Physical Examination Findings

At admission, the patient's temperature was 36°C, her BP was 148/75 mm Hg, respiratory rate was 20 breaths/min, and pulse oximetry was 95% on room air. Lung auscultation revealed a diffuse phlegm sound. The abdominal examination was normal.

Diagnostic Studies

Arterial blood gases showed PaO_2, 102 mmHg; $PaCO_2$, 30 mm Hg; and lactate, 0.8 mmol/L (normal value, <1.3 mmol/L). Levels of serum KL-6 were 560.0 U/ml with a significantly increased. Results of other routine laboratory examinations were normal.

Her left ventricular ejection fraction (LVEF) and left ventricular fractional shortening (LVFS) were both within normal ranges on ultrasonography of her heart. On the second day after admission, a chest computed tomography (CT) scan showed: double lung pneumonia, considering viral pneumonia with atelectasis in the middle lobe of the right lung (Figure 1).

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Given the patient's mild symptoms and good general condition, she received oral medication, including antiviral (Traditional Chinese medicine treatment for 15 days: Lianhua Qingwen Capsules, 2 Caps, bid), antihypertensive drug (Levo Amlodipine, 2.5mg, bid) and was not treated with antibiotics. By monitoring arterial blood gases, it was determined that the patient's ventilation was good. During hospitalization, only oxygen therapy with a mask (continuous medium flow oxygen inhalation, 2-4 L/min) was used. After 6 days of treatment, the patient was retested for rRT-PCR, a nasopharyngeal swab performed for SARS-CoV-2 and the result turned negative. The patient's chest CT on April 22 showed that the lesion in the middle lobe of the right lung was partially reduced in extent and faded in density compared to the previous one (Figure 2). After a total of 15 days of treatment, the patient was stabilized and discharged from the hospital.

DISCUSSION

The clinical case we report is a 106-year-old woman, who presented with mild symptoms and a chest CT showing imaging features of COVID-19. This female patient was the oldest patient since 2019 and was in good physical condition with no other comorbidities except hypertension, but she had not received the COVID-19 vaccine. Despite the patient's advanced age, she recovered well from COVID-19. Overall, however, older persons are vulnerable to the COVID-19 pandemic and have adverse outcomes. According to data provided by the Chinese Center for Disease Control and Prevention in 2020, patients 80 years of age and older made up 3% of those infected with COVID-19 and had a 14.1% mortality rate, with patients with comorbidities having a higher rate of mortality (Wu & McGoogan *et al.* 2020).

The progressive decline of the immune defense system, more comorbidities, and higher levels of proinflammatory cytokines in older adults contribute to more severe COVID-19 (Gao *et al.* 2021). Our patients' laboratory tests revealed that the majority of the elderly had a smaller amount of CD4+ and CD8+ T cells, as well as higher levels of serum IL-6. In the fight against viral infections, T and B cells are crucial. Aging leads to many changes in the immune system, mainly in the following ways: 1) thymus atrophy reduces the total number of naïve T cells produced, 2) the generation of naïve B cells is reduced as a result of age-related bone marrow malfunction, and 3) lymph nodes are progressively less able to maintain T cells and B cells and coordinate the immune response (Nikolich-Zugich *et al.* 2020). As a result, in the event of SARS-CoV-2 infection, older persons are less likely to generate a fast, high-affinity immune response, leading to increased susceptibility (Bajaj *et al.* 2020). After being infected by SARS-CoV-2, T cells are depleted by the continuous stimulation of the virus, forming a vicious cycle that further aggravates the disease (Diao *et al.* 2020). Since most older adults have comorbidities and reduced lung function, clinicians need to pay attention to patients' immune indicators to prevent secondary infections. The SARS-CoV-2 vaccine is especially needed to boost immune defenses in the elderly due to their increased susceptibility. Although the immunogenicity of the SARS-CoV-2 vaccine declines with age owing to immunological aging, repeated immunization can still successfully boost the immune response in the elderly (Collier *et al.* 2021). Unfortunately, the patient we reported was not vaccinated against SARS-CoV-2, but her milder condition suggested that she had a better immune function and might have successfully fought off the SARS-CoV-2 infection if she had been vaccinated before this. In addition, the patient we reported

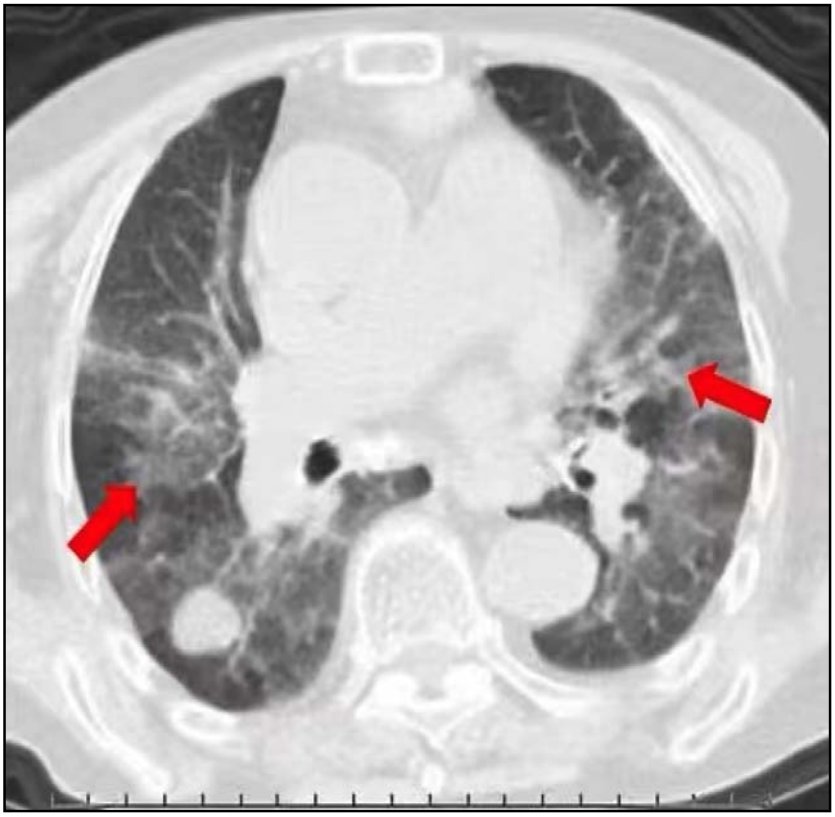

Fig. 1. A chest CT at onset scan showed: Double lung pneumonia, considering viral pneumonia with atelectasis in the middle lobe of the right lung.

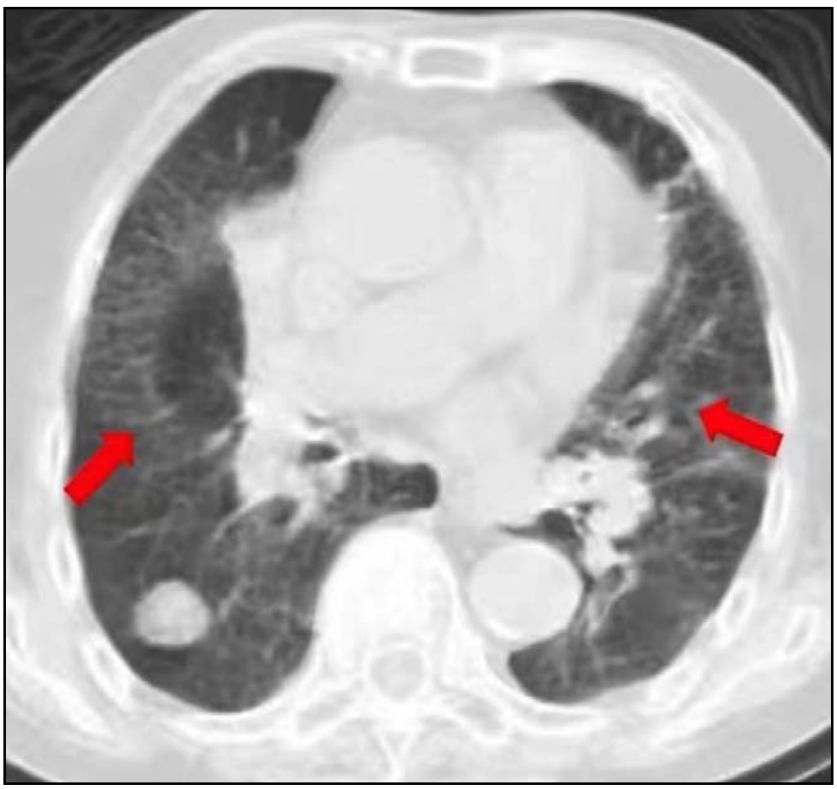

Fig. 2. A chest CT after treatment showed that the lesion in the middle lobe of the right lung was partially reduced in extent and faded in density compared to the previous one.

had hypertension, which is considered an independent risk factor for severe COVID-19. Higher average systolic blood pressure, as well as unstable systolic and diastolic pressure, were linked to Intensive care unit admission, cardiac failure, and mortality in COVID-19 patients with comorbid hypertension, proposing that maintaining lower and stable blood pressure, particularly systolic blood pressure, may be associated with a better prognosis (Ran *et al.* 2020). Therefore, aggressive blood pressure control is recommended for COVID-19 patients who have hypertension.

Moreover, there is a definite correlation between the severity of COVID-19 and gender. A review summarizing biomarkers associated with COVID-19 infection suggested that biological sex had an influence on the relationship between biomarkers and illness severity/outcome (Haitao T *et al.* 2020). Female patients presented a stronger T cell response than male patients over the course of the SARS-CoV-2 infection, as well as the T cell response was inversely linked with age in male patients and not in female patients (Takahashi *et al.* 2020). The combination of these factors contributes to the fact that female patients may have a better prognosis than male patients.

Imaging of the patient's chest CT showed that the patient we reported had an exacerbation during her hospitalization, and laboratory findings showed elevated levels of serum KL-6. KL-6 is a mucin-like high molecular weight glycoprotein produced by damaged or regenerating alveolar type II pneumocytes, and might be utilized as a novel biomarker of COVID-19 (d'Alessandro *et al.* 2020). Xue *et al.* showed that the levels of KL-6 were substantially linked with inflammatory factors, Oxygenation index (PaO_2/FiO_2) and pulmonary lesion area, reflecting the degree of lung inflammation, ventilatory function, and the damage to alveolar epithelial (Xue *et al.* 2020). These findings suggest that KL-6 levels correlate with the severity of COVID-19 and that its significant elevation reflects the deterioration of the patient's condition, making it important to closely monitor changes in these biomarkers

in high-risk populations. It is remarkable and unusual that even at such an age there are rare cases of patients who are in good physical, mental, and general condition, which helps them overcome such a disease as COVID 19. The often-present polypharmacy of elderly patients is not often beneficial for them. Perhaps these factors (history, few medications etc.) had a surprising effect on the good result of this patient.

In conclusion, this case illustrates that throughout the COVID-19 pandemic, we should pay close attention to the risk factors present in elderly individuals that might result in severe COVID-19 and establish individualized treatment plans based on each patient's condition. In a meta-analysis, the nursing home testing population had the highest percentage of asymptomatic infections (Ma *et al.* 2021). Therefore, in nursing facilities, the risk of potential transmission of COVID-19 is greater. Given that the elderly is one of the susceptible populations to COVID-19, active vaccination against SARS-CoV-2 is recommended to lower the risk of infection. At the same time, focusing on biomarkers related to COVID-19 severity may help clinicians identify high-risk patients, predict disease progression, and promptly adjust treatment strategies to prevent disease deterioration and adverse outcomes.

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AUTHORS' CONTRIBUTIONS

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CONFLICT OF INTEREST

Not applicable.

ETHICAL APPROVAL

The study protocol was approved by the Ethics Committee of the Jilin University, Changchun, China.

DISCLOSURE OF FUNDING

Not applicable.

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