Severe pneumonia with co-infection of H5N1 and SARS-CoV-2: a case report

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Case Report

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Abstract

Background H5N1 influenza is a cause of severe pneumonia. Co-infection with influenza and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) may lead to poor prognosis in the epidemic of COVID-19. However, few studies have reported regarding patients co-infected with avian influenza and SARS-CoV-2.

Case presentation A 52-year-old woman presented with fever for eight days and worsening shortness of breath and decreased blood pressure. Computed tomography (CT) revealed air bronchogram, lung consolidation and bilateral pleural effusion. Furthermore, polymerase chain reaction (PCR) of the bronchoalveolar lavage fluid (BALF) showed positivity for H5N1 and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Conclusion H5N1 influenza is a cause of severe pneumonia. The clinical presentation of the patient had a predomination of H5N1 influenza rather than COVID-19. A viral PCR analysis is necessary to demonstrate the pathogen of severe pneumonia. The patient exhibited an excellent prognosis upon the appropriate use of antiviral medicine.

Background

Avian influenza virus (AIV) is a significant threat to public health owing to the associated high mortality rate and its novel variants[1]. H5N1 virus is a subtype of AIVs that has been circulating among wild birds for the past few years. H5N1 infection commonly developed respiratory stress and pneumonia in human[2]. The first case of transmission from poultry to a human was reported in 1997 in Hong Kong. Its main transmission includes transmission from animals to humans, animals to animals, and the environment to humans[3]. Since then, several intermittent outbreaks have been reported in the human population across the world.

SARS-CoV-2, leading to various degree of pneumonia, has become a constant threat to global health since 2019[4]. Co-infection of this virus, particularly with the pathogens responsible for pneumonia, has been attracting great attention since the beginning of the pandemic. According to reports, co-infection of SARS-CoV-2 with different influenza viruses has a higher fatality rate compared to COVID-19 infection alone[5]. However, an extensive literature search revealed no case reports of co-infection in which the category of influenza virus could be identified. In this context, we discusses a case of severe pneumonia induced by co-infection with H5N1 and SARS-CoV-2 in China where anther surge of COVID-19 was happened.

Case presentation

A 52-year-old woman who lived in the countryside after retirement in Anhui province in China developed a fever on 1 February 2023. The patient was administered antibacterial treatment with piperacillin/tazobactam and levofloxacin in the local hospital. However, two days later, the symptoms

worsened along with shortness of breath and decreased blood pressure. The patient was then transferred to the emergency department of Jiangsu province people's hospital. The patient had no history of smoking, hypertension, or diabetes.

At admission, the patient had a body temperature of 39°C, worsening shortness of breath, a blood pressure of 104/67 mmHg, a heart rate of 103 bpm, and PaO_2/FiO_2 of 86 mmHg. The laboratory examination results revealed increased levels of C-reactive protein (88.7 mg/L) and procalcitonin (4.82 ng/mL). The throat swaps for COVID-19 were negative. Multiple patchy shadows were visible in coronal CT of the lung (Fig. 1A). In addition, air bronchogram were predominant in the upper lobe and the right middle lobe, along with lung consolidation and bilateral pleural effusion, in the axial imaging (Fig. 1B). Accordingly, the patient was immediately placed on a non-invasive ventilator and methylprednisolone (40 mg once daily) for the management of the severe acute respiratory distress syndrome. Next, the sputum samples of the patient were analyzed. The culture, bacterial PCR, and fungal PCR from the sputum samples were negative. The subsequent immunological tests for tuberculosis and common respiratory pathogens were also negative. On the night of 7 February 2023, the patient appeared irritable and was transferred to the intensive care unit (ICU).

Upon admission to the ICU, the patient was placed on intratracheal intubation and mechanical ventilation. The BALF was retrieved for metagenome next-generation sequencing (mNGS). Three days after admission to the ICU, the mNGS results were obtained, which were positive for H5N1 (supplementary material). Therefore, a viral PCR analysis of the sputum and BALF was performed, which confirmed the presence of the H5N1 influenza virus and presented a positive result for SARS-CoV-2. Accordingly, co-infection with H5N1 and SARS-CoV-2 was identified as the etiology of the patient's severe pneumonia. The patient was administered Peramivir (0.6 g once daily) and nirmatrelvir-ritonavir (300 mg-100 mg, every 12 h) for 5 days.

After treatment with the antivirals, the inflammation indices and temperature of the patient improved. Thirteen days after admission to the ICU, the pulmonary inflammation had subsided, as evidenced by the CT images (Fig. 2A, B). Therefore, mechanical ventilation was withheld, and the corticosteroid was discontinued. Twenty-seven days after admission to the ICU, the patient tested negative for both H5N1 and SARS-CoV-2 and was discharged from the hospital.

Discussion and conclusions

We searched the PubMed database using the terms "H5N1", "COVID-19"and "co-infection", and found no articals that reported co-infection with H5N1 and COVID-19. According to reports, under proper supervision, the incidence rate of avian H5N1 influenza in humans has been decreasing[6, 7]. However, the mortality rate due to severe acute respiratory stress induced by the H5N1 virus has remained high[8]. In China, when the implementation of "zero COVID" strategies was abandoned on 7 December 2022, a surge was recorded in the cases of Omicron infection[9]Co-infection of this virus, particularly with the pathogens responsible for pneumonia, has been attracting great attention since the beginning of the

pandemic. According to reports, co-infection of SARS-CoV-2 with different influenza viruses has a higher fatality rate compared to COVID-19 infection alone[5]. Numerous cases of infection with both SARS-CoV-2 and influenza A virus were reported during the COVID-19 epidemic, while only a few cases presented co-infection of SARS-CoV-2 with H5N1[10]. In the present case, no other member in the patient's family was infected with H5N1, except for the patient who was exposed to sick poultry, which demonstrated that the spread of this virus is limited to animal-to-human transmission. Therefore, it is recommended to ensure the protection of the upper respiratory tract of humans against the droplets containing AIVs, particularly when the individual has to be or has been in contact with chickens and birds.

The CT images that indicate co-infection depict the symptoms of interstitial infiltrates, lung consolidation, diffuse ground-glass opacities, and air bronchogram, which are similar to those observed in the common viral infection [11]. In addition, the clinical presentations are the same as those in the case of isolated H5N1 infection. Therefore, a single examination for influenza virus and COVID-19, such as PCR for throat swabs, usually presents a relatively low sensitivity. Moreover, higher viral loads have been evidently detected in the BALF compared to the nasopharyngeal samples[2]. In the event of viral pneumonia, timely antiviral treatment is key to decreasing mortality[10]. Therefore, for the present case, the mNGS of the BALF samples and the PCR test were performed to verify the diagnosis, which played a vital role in clarifying the etiology of viral pneumonia[12]. After the diagnosis, considering infection with both viruses, the corresponding two categories of antiviral medicine were prescribed. Although it is reported that co-infection with influenza and COVID-19 leads to a poor prognosis, the antiviral and anti-inflammation treatment administered in the present case could relieve lung inflammation, thereby leading to a great prognosis.

In conclusion, it is important to state that co-infection with H5N1 and SARS-CoV-2 may not lead to a terrible prognosis if timely treatment is administered. In fact, the other kinds of influenza viruses might improve the mortality of the patients infected with SARS-CoV-2. However, even though the present case of co-infection with H5N1 and SARS-CoV-2 did not lead to further severe demonstrations, it is recommended to ensure further accurate treatment by verifying the pathogen responsible for severe pneumonia through various examinations.

Abbreviations

SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
CT	Computed tomography
PCR	Polymerase chain reaction
BALF	Bronchoalveolar lavage fluid
AIV	Avian influenza virus
ICU	intensive care unit

mNGS	Metagenome next-generation sequencing

Declarations

Acknowledgement

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Author's contributions

Ke Jin, Ping Shi, Chuanlong Zhu involved clinical management of the patient and collect the data. Zixing Dai draft the manuscript and figures. Yuwen Li, Chuanlong Zhu critically revised the manuscript. All authors approved the final version and agreed to be accountable for all aspects related to accuracy and integrity of the work.

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Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Not applicable

Consent for publication

Written informed consent for publication of their clinical details and clinical images was obtained from the patient

Competing interests

The authors declare that they have no competing interests

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Figures

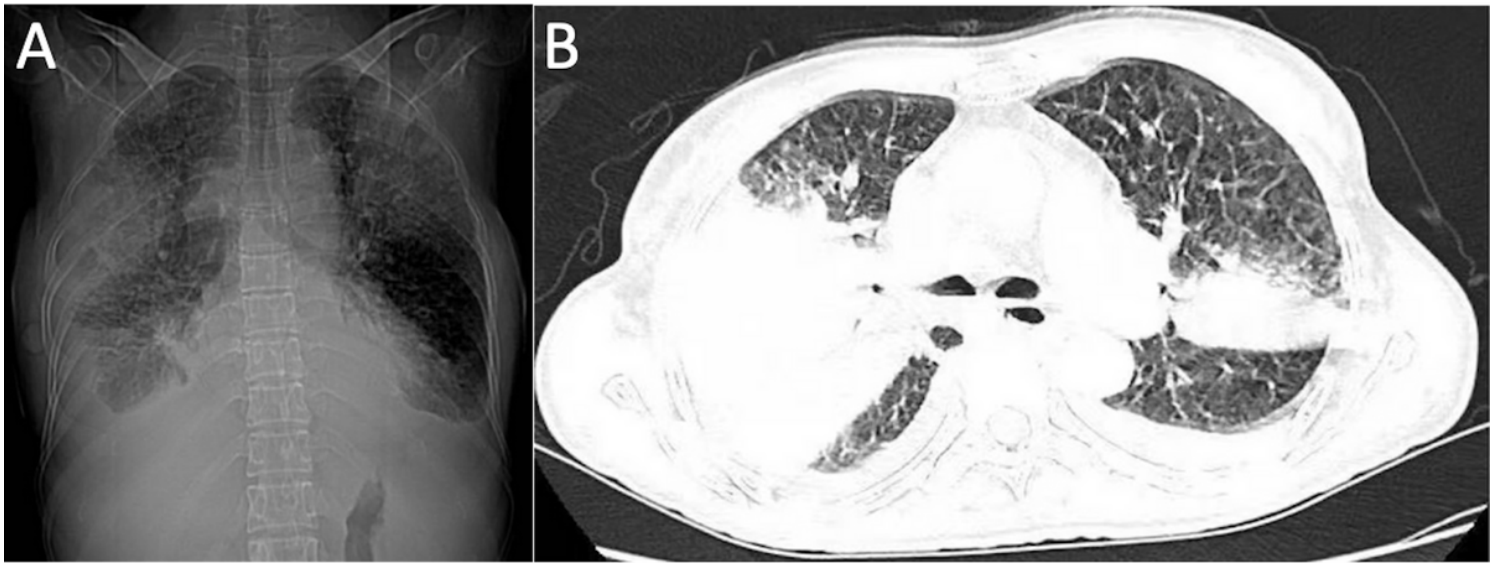

Figure 1

CT images prior to and after the treatment of the patient co-infected with H5N1 and COVID-19. After admission, the patient's radiology presented an air bronchogram, lung consolidation, and bilateral pleural effusion (A and B).

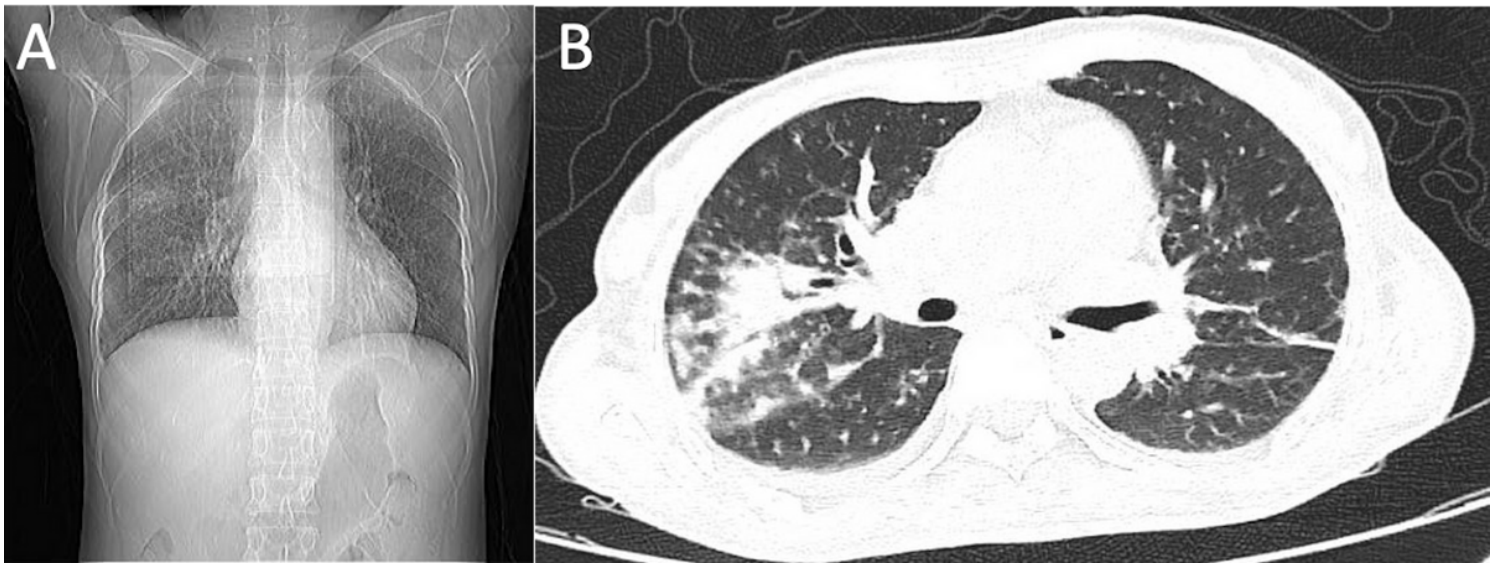

Figure 2

Ten days after treatment with the antivirals, the lung inflammation was relieved (A and B).

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