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CASE REPORT

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Legionella pneumophila pneumonia with rapid clinical course in a lung cancer patient

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Abstract

We report an acute clinical course of pneumonia caused by *Legionella pneumophila* in a patient receiving chemotherapy for lung cancer and corticosteroid therapy. A 57-year-old man presented with fever and dyspnoea and was admitted to our hospital. Chest computed tomography revealed a new left lower lung infiltrate, tumour progression in the right upper lung region, metastases to lymph nodes and pleural effusion. The urinary antigen test for *Legionella* was positive. The patient's oxygen requirement increased on the day of admission, and he died the day after hospitalization. Legionnaires' disease may manifest with an acute presentation, and patients in Japan with physical risk factors for this disease could get infected despite the absence of environmental risk factors. Early treatment for suspected Legionnaire's disease should be considered.

KEYWORDS
Legionella pneumophila pneumonia, Legionnaires' disease, lung cancer

INTRODUCTION

Legionnaires' disease was first identified in 1976 during the investigation of a major pneumonia outbreak in Philadelphia. It is mainly transmitted via infectious aerosols.[1] Symptoms of Legionnaires' disease range from mild to severe, with a reported mortality rate of approximately 6%.[2] Limited evidence exists regarding the interval between the onset of Legionnaires' disease symptoms and hospital admission. We report a case wherein *Legionella pneumophila* pneumonia developed rapidly and without obvious environmental risk factors in a lung cancer patient in Japan.

CASE REPORT

A 57-year-old man was admitted to our hospital with fever and dyspnoea. These symptoms occurred on the morning of the admission date. He was previously a smoker and had a history of drinking 2 U of alcohol per day. He was diagnosed with adenocarcinoma at the right upper lung lobe 5 months prior with a complete tumour staging of cT4N3M1c Stage IV B, pericardial metastasis, pleural metastasis and multiple bone metastases. He had received corticosteroids for 4 months for drug-induced pneumonia due to pembrolizumab or pemetrexed, which occurred during the first cycle of first-line chemotherapy. Prednisolone 60 mg per day was administered and then tapered off; following this, he was on dexamethasone 2 mg per day at the time of admission. He was administered two cycles of carboplatin (area under the curve of 6 mg/ml/min) and nab-paclitaxel (100 mg/m^2) as second-line chemotherapy. The last administration of chemotherapy was 1 month before admission due to tumour progression and deterioration of his general condition to an Eastern Cooperative Oncology Group performance status of 2. Three weeks before admission, a thoracentesis had been performed for an increasing right pleural effusion, and a diagnosis of malignant pleural effusion had been made. He had never been previously diagnosed with atrial fibrillation. Ten days before admission, his haemoglobin A1c level was 5.6%, and he had never been diagnosed with diabetes before. Apart from one out-of-

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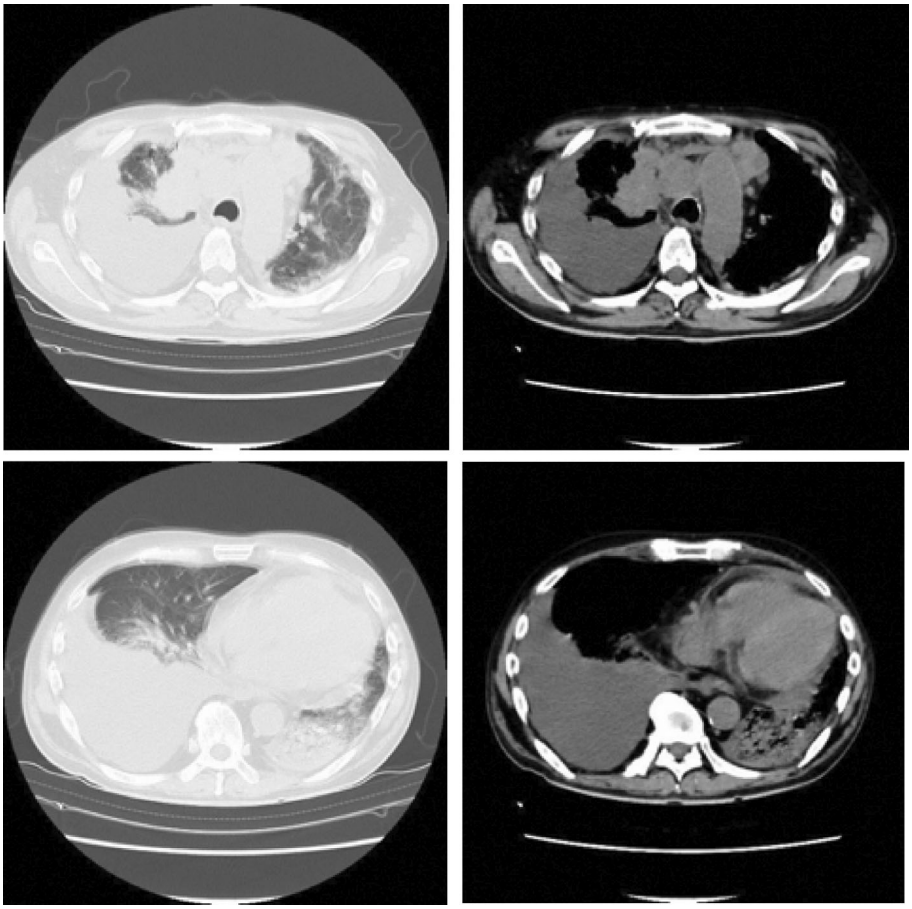

FIGURE 1 Computed radiographs upon presentation show a new left lower lung infiltrate, tumour progression in the right upper lung, metastases to lymph nodes and pleural effusion

home visit to his mother, he stayed home for 2 weeks before admission because of the spread of severe acute respiratory syndrome coronavirus 2 infection. Therefore, he had no contact with hot springs, spas, recirculating tubs or soil for 2 weeks before his hospitalization.

At the time of emergency room visit, the patient's temperature was 39.0°C, heart rate was 168 beats/min with atrial fibrillation, blood pressure was 139/105 mmHg, respiratory rate was 25 beats/min and oxygen saturation was 98%, despite oxygen supplementation at 6 L/min. Laboratory tests revealed a white blood cell count of 22.3×10^9 cells/L, and C-reactive protein was elevated at 24.5 mg/dl. Other biochemical tests showed liver function abnormalities (aspartate transaminase, 106 IU/L; alanine transaminase, 146 IU/L); elevated lactate dehydrogenase (455 IU/L); and hyponatremia (sodium, 127 mEq/L). The creatine kinase level was within the normal range (240 IU/L), and the platelet count was 145,000/μl. Chest radiography revealed a new left lower lung infiltrate, tumour progression in the right upper lung region, metastases to lymph nodes and pleural effusion (Figure 1). An antigen test for severe acute respiratory syndrome coronavirus 2 was negative. The BinaxNOW urinary antigen test was positive for *Legionella* and negative for *Streptococcus pneumoniae*.

Initially, intravenous piperacillin/tazobactam was administered despite the above-mentioned test results. He also received dexamethasone supplementation for glucocorticoid coverage. However, his oxygen demand increased, and his consciousness worsened on the day of admission. He was transferred to the intensive care unit and was then intubated. Following intubation, his heart rate increased to 200 beats/min with atrial fibrillation and underwent cardiac arrest within a few minutes. Return of spontaneous circulation was achieved within 2 min, and the cause of cardiac arrest was thought to be a pause in atrial fibrillation. Levofloxacin was administered following initial cardiac arrest. Normal cardiac rate and sinus rhythm were achieved, but hypotension, probably due to sepsis, persisted, and he died the day after hospitalization. An autopsy was not performed. After his death, *L. pneumophila* serogroup 1 was isolated on sputum culture on buffered charcoal yeast extract agar; no other pathogens were detected.

DISCUSSION

We report a case of *L. pneumophila* pneumonia with a rapid clinical course in a patient with lung cancer. This case

demonstrates two important issues. First, the clinical course of *L. pneumophila* pneumonia may be acute. Second, immunosuppressed patients in Japan could be infected with *L. pneumophila* pneumonia even if the clinical history revealed no environmental risk factors.

Little is reported on the interval between the onset of symptoms of Legionnaires' disease and hospital admission. One observational study of 39 cases of legionellosis by Heath et al. reported that the prodromal period ranged from 2 to 14 days, with a median of 5 days.[3] In this study, patients who died tended to have a longer median prodromal period than those who survived (7 vs. 5 days). Contrastingly, in our case, the prodromal period lasted ≤12 h; the clinical course after admission was acute and fatal without other concurrent pathogens detected. The reason for the acute clinical course was that the main cause of cardiopulmonary arrest was circulatory collapse associated with sepsis rather than pneumonia and subsequent acute respiratory distress syndrome.

Host defences to *Legionella* species are primarily cell-mediated. Several risk factors for infection have been described, including advancing age, male sex, cigarette smoking, recent surgery, chronic lung disease and immunosuppression, particularly corticosteroid therapy.[4–7] In Europe, community-acquired legionellosis is more common than travel-related or healthcare-associated *Legionella* infections; however, evidence is limited in Japan.[8] Our patient possessed several risk factors for Legionnaires' disease but no known environmental risk factors. He developed this infection in Japan, where the prevalence of *L. pneumophila* pneumonia among the various forms of community-acquired pneumonia is approximately 1% and is lower than that in other countries.[9,10]

Delay in appropriate therapy for *L. pneumophila* pneumonia is associated with increased mortality.[3] In our case, despite levofloxacin following the first cardiac arrest, it was too late. A urinary antigen test can detect *L. pneumophila* serogroup 1 with approximately 100% specificity in patients with *Legionella* pneumonia caused by this bacterium[11] and should be performed for suspected cases. Clinicians should consider testing for *L. pneumophila* and administer corresponding empiric therapy for patients with risk factors or critically ill patients.

The clinical course of pneumonia caused by *L. pneumophila* could be acute, and immunosuppressed patients and those at risk of developing Legionnaires' disease could be infected despite the absence of environmental risk factors in Japan. If *L. pneumophila* pneumonia is suspected or if the urine antigen test for *Legionella* is positive, administration of anti-*Legionella* antibiotics should be started promptly.

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CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTION

All authors contributed to the patient's therapy and this submission. All authors contributed to the conception and interpretation of the work and drafting and revision of the work.

ETHICS STATEMENT

The authors declare that appropriate written informed consent was obtained for the publication of this manuscript and accompanying images.

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