Rapidly Expanding Lung Abscess Caused by *Legionella pneumophila* in Immunocompromised Patients: A Report of Two Cases

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Abstract

We describe two cases of lung abscess caused by *Legionella pneumophila* in immunocompromised patients. The first case had been treated initially with 60 mg prednisolone for ulcerative colitis, and *L. pneumophila* serogroup 1 was isolated from sputum samples after cavitation of the lung lesion. The second case was diagnosed as plasma cell lymphoma at post-mortem examination. *L. pneumophila* serogroup 5 was isolated from the contents of lung abscess, together with *Enterococcus faecium* and *Prevotella intermedia* in the post-mortem examination. Lung abscess caused by *Legionella* is unusual. Here, we discuss the difficulty of diagnosis of legionellosis in patients with unusual chest radiographic findings.

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Key words: legionellosis, pneumonia, oropharyngeal aspiration, chest radiogram, computed tomogram, urinary antigen detection

Introduction

Legionella is an important causative pathogen of bacterial pneumonia. Pneumonia caused by this pathogen is indistinguishable from that caused by other bacteria. Lung abscess caused by this organism is unusual and only a few cases have been reported in the literature (1–7). We encountered two cases of *Legionella* lung abscess with immunocompromised status. To our knowledge, only one case of *Legionella* lung abscess was reported in Japan previously (7). Here we discuss the difficulty of diagnosis of legionellosis in patients with unusual chest radiographic findings and on the possible role of oropharyngeal aspiration in the transmission of legionellosis.

Case Report

Case 1

A 30-year-old woman was admitted to the hospital for further management of ulcerative colitis. She was treated with 60 mg of oral prednisolone followed by gradual tapering of the dose. Twenty-seven days after commencement of this treatment, she developed *Herpes zoster* infection, which was successfully treated with aciclovir. Forty-five days after commencement of prednisolone therapy, when the dose was tapered to 30 mg per day, she developed fever of 38.8°C. The patient complained of mild cough and left pleuritic pain. Laboratory examination showed a leukocyte count of 13,900/mm³ and CRP level was 9.49 mg/dl. The chest radiograph showed a well-defined round opacity in the left upper lobe (Fig. 1) that had not been present on admission. Computed tomogram of the chest obtained on the following day revealed multiple areas of infiltration (Fig. 2). Two days after the chest radiogram shown in Fig. 1, the opacities were noted to have expanded rapidly (Fig. 3), which coincided clinically with the deterioration of dyspnea. On the same day, we obtained a specimen for determination of the causative microorganism by broncho-endoscopy but culture of the aspirated fluid showed no significant growth of organisms. Based on this finding, the administered antibiotic was switched from 2.0 g of piperacillin to 1.0 g of panipnem/betamipron. In spite of the treatment, the infiltrative shadow grew in size and a new cavity was recognized (Fig. 4). This was associated clinically with expectoration of purulent sputum. At that stage, sputum smears were negative for Gram stain but thin rods were identified in smears prepared by Gimenez stain. Further cultures of sputum samples on buffered charcoal yeast extract with alpha-ketoglutarate (BCYE-alpha) agar plates resulted in the isolation of *Legionella pneumophila* serogroup 1 on two separate occasions. After confirmation of these colonies, erythromycin, levofloxacin and rifampicin were administered in combination for the treatment of the abscess caused by *Legionella pneumophila* serogroup 1.

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Figure 1. Case 1. Chest radiograph showing a well-defined round opacity with clear border in the left upper lobe.

Azithromycin and intravenous fluoroquinolone were not available at that time in Japan. Specific urinary antigen detection (Binax, Inc., Portland, Maine, USA) was also positive and serum anti-*L. pneumophila* serogroup 1 antibody titers were elevated from 1:32 to 1:256. After six weeks of treatment, these abscesses healed but multiple thin-wall cavities were noted on the chest radiograph (Fig. 5). Specific urinary antigen was detected for a period of three months. Although, oxygen saturation while breathing room air was maintained over 96% during the course of the disease, the patient was tachypneic (breathing rate: up to 30 per minute). Accordingly, supplemental oxygen therapy was provided at 3 l/min.

Case 2

A 73-year-old man was admitted to our hospital for a one-week history of persistent fever of 38°C. He complained of easy fatigability, and physical examination showed generalized lymphadenopathy, splenomegaly and anemia. Laboratory tests showed a peripheral leukocyte count of 18,700/mm³, CRP of 10.8 mg/dl, and hemoglobin of 9.7 g/dl. Pathological examination of a cervical lymph node biopsy showed features of reactive lymph node swelling. Bone marrow examination and surface marker analysis of lymphocytes were not informative and could not establish the diagnosis. Fever was persistent but repeated blood cultures were negative. Nine days after hospitalization, body temperature increased to 40°C and computed tomogram of the chest showed a round opacity in the left S³ (Fig. 6), which was not evident on the chest radiograph taken

A

B

Figure 2. A, B. Case 1. Computed tomogram of the chest obtained on the day following the chest X-ray shown in Fig. 1. Note the presence of multiple infiltrates.

on admission. Laboratory results at that stage showed peripheral leukocytosis (23,300/mm³) and elevated CRP (20.9 mg/dl). Arterial blood gas analysis while breathing room air showed pH; 7.51, PaCO₂; 25, PaO₂; 64, HCO₃⁻; 25.2 and BE; -1.5. In spite of administration of piperacillin and isepamicin following the recognition of the pulmonary infiltrate, the chest opacity expanded rapidly. To determine the causative organism,

Figure 3. Case 1. Two days after the chest radiograph of Fig. 1. Note the rapid expansion of the round opacities.

Figure 4. Case 1. Four days after the chest radiograph shown in Fig. 1. Note the presence of cavitation in the dense consolidation.

Figure 5. Case 1. Three months after the chest radiograph of Fig. 1. The abscesses healed but multiple thin-wall cavities were left.

Figure 6. Case 2. Computed tomogram of the chest taken nine days after hospitalization. Note the presence of a round opacity in the left S³, which was not evident on the chest radiograph taken few days earlier.

broncho-endoscopic examination was performed on the 11th day of hospitalization. However, no pathogenic organisms were isolated from the bronchial aspirate and Gimenez stain examination was negative. Three days after the first chest computed tomogram, the dense consolidation showed further expansion (Fig. 7A) and 10 days later, cavitation was subsequently noted

in the consolidation (Fig. 7B). On the 29th day of hospitalization, the patient suddenly developed acute renal failure and died of cardiac arrhythmia. Post-mortem examination performed on the same day revealed that the pre-existing condition was plasma cell lymphoma. The content of lung abscess in the left upper lobe was aspirated under aseptic conditions. *L. pneumophila* serogroup 5, *Enterococcus faecium* and *Prevotella intermedia* were simultaneously isolated from the specimen. The patient had not used a shower for bathing due to the severe clinical condition, and no nasogastric tube was used during hospitalization.

Discussion

We describe two immunocompromised patients with lung abscess. The disease commenced as a nodular pulmonary consolidation without obvious interstitial change that expanded rapidly and finally developed into lung abscess. The diagnosis was established by isolation of *L. pneumophila* in both cases. The chest radiographic findings were unusual for *Legionella* pneumonia in Japan (7) therefore we did not suspect pneumonia caused by *Legionella* species until isolation of the organism. However, similar findings on the chest radiogram in patients with legionellosis have been described in Western countries mainly in immunocompromised patients (1–6) such as post-transplant patients (2, 3), patients on high-dose corticosteroid therapy (1, 4) and AIDS patients (6). The causative pathogen in these reports was *Legionella micdadei*, formerly known as “Pittsburgh Pneumonia Agent”. In Japan, only one case of lung abscess caused by *Legionella dumoffii* had been reported previously (7). The exact mechanism of transmission and frequency of lung abscess in legionellosis are not clear. However, from the description in western countries (1–4, 6), abscess formation is often detected in legionellosis in immunocompromised patients. Therefore, legionellosis should be considered in the differential diagnosis of a round opacity in the chest radiogram in febrile immunocompromised patients.

Legionella species is a facultative intracellular growth pathogen and it multiplies in phagocytosed macrophages, therefore, the main growth inhibition mechanism of the host defense against *Legionella* species is cell-mediated immunity (8). For this reason, immunocompromised status is one of the major risk factors of *Legionella* infection. In our patients, Case 1 received long-term corticosteroid therapy and Case 2 was diagnosed as plasma cell lymphoma, but both had almost intact non-immunospecific defense mechanism including neutrophils. Although the exact mechanism of abscess formation in the lung of immunocompromised patients by *Legionella* is not clear yet, it is possible that the number of *Legionella* is markedly increased in the infected area in such patients, but the host non-immunospecific inflammatory reaction aimed at localization of the inflammation subsequently results in necrosis of the lung parenchyma and abscess formation in immunocompromised patients.

Although aerosolization is the widely accepted mode of transmission of *Legionella*, a number of investigators (9–12)

A

B

Figure 7. A, B. Case 2. Chest radiograph showing rapid expansion of the dense consolidation (A) and cavitation (B).

suggested that oropharyngeal aspiration might be the mode of transmission in at least a proportion of patients with *Legionella* pneumonia. In Case 2, *L. pneumophila* serogroup 5 was isolated simultaneously with *E. faecium* and *P. intermedia*. This finding suggests that aspiration of oropharyngeal secretion was the sole mechanism of legionellosis. Furthermore, this finding also suggests that the bacteria in the oral cavity might synergistically enhance *Legionella* species-induced abscess formation.

Isolation of the microorganism is the golden standard for the correct diagnosis of legionellosis, therefore we attempted to isolate *Legionella* including staining of bronchial aspirates obtained by broncho-endoscopy by Gimenez staining, although this procedure failed to detect the causative microorganism. It is noteworthy that multiple pathogens were involved in the second case. To our knowledge, only a few cases have reported the identification of multiple pathogens in patients with legionellosis. Therefore, further studies of this type of infection and transmission through oropharyngeal aspiration are necessary.

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