CASE REPORT

A 38-year-old apparently healthy woman complained of fever and dry cough after visiting Los Angeles, CA. Her medical history did not reveal any specific illness, including acquired immune deficiency syndrome. She did not smoke or consume alcohol. During her 3-day stay, she visited the beach in California. On her way to the beach, she encountered a dust storm and inhaled a large amount of dust. Seven days after she returned to Japan (9 days after encountering the dust storm), she was admitted to a local hospital in Nagasaki owing to a progressive dry cough (clinical day 8). On admission, the vital signs of the patient were as follows: body temperature, 37.5°C; blood pressure, 99/64 mm Hg; pulse, 72 beats/min with a regular rhythm; SpO₂, 96% in a room air condition; and respiratory rate, 16 breaths/min. Cyanosis, cardiac murmur, and breath sounds were absent. Moreover, her liver, spleen and lymph nodes were not palpable. Her white blood cell count was 7.3 × 10⁹/ml, with a shift to the left (71% neutrophils), and her C-reactive protein value was 5 mg/dl (normal range, 0 to 0.3 mg/dl). The chest computed tomography (CT) images revealed multiple round lesions located on both lobes, with diameters of 0.5 to 1 cm (Fig. 1 and 2). The radiological findings strongly suggested metastatic tumors; hence, digestive tract endoscopy and positron emission tomography (PET) of the entire body were performed. No other lesions, except the lesions in the lungs, were found. No other lesions, except the lesions in the lungs, were found. Therefore, we performed an additional histological examination and a transbronchial biopsy (TBB) using endobronchial ultrasonography with a guide sheath. The histological examination revealed only nonspecific inflammation. Thus, there was a possibility of coinfection with other etiologic pathogens. The Coccidioides antibody was not detected on clinical day 32. However, the patient’s samples were negative.

Although a Gram-positive rod bacterium was isolated from the BALF cultures, the histological findings of the TBB specimen could reveal only nonspecific inflammation. Thus, there was a possibility of coinfection with other etiologic pathogens. The Coccidioides antibody was not detected on clinical day 32. However, owing to her unique travel history and radiological findings, we could not completely exclude the possibility of acute pulmonary coccidioidomycosis. Therefore, we performed an additional histological assessment and repetitive examinations for detection of
Coccidioides antibody to confirm the diagnosis. On clinical day 36, video-assisted thoracoscopic surgery (VATS) was performed to acquire lung tissue. During VATS, the nodule (30 mm) in the right lower lobe was resected and examined. On histological examination, lymphocyte infiltration, fibrous change, and several Masson bodies were found within the resected nodule, but no pathogen, including *Coccidioides*, was identified by pathological or microbiological examination. On clinical day 53, after confirming the result of VATS and obtaining negative results for the repetitive tests for serum antibody against *Coccidioides*, we replaced TAZ-PIPC and L-AMB with amoxicillin (AMPC) therapy at 2 g/day. After 2 months of administration, the pulmonary abscesses were no longer detected on radiological examination.

Because of the rarity of her clinical course, we performed molecular identification by PCR amplification and sequencing analysis of the 16S rRNA gene using DNA extracted from the isolates. The universal primers 8UA (5′-AGAGTTTGATCMTGGCTCA G-3′) and 1485B (5′-ACGGGCGGTGTGTRC-3′) were used, as described previously (9). We performed a sequencing analysis using a GenBank BLAST search and BiBi (http://pbil.univ-lyon1.fr/) phylogenetic tools. The sequence of the 16S rRNA gene showed 99.7% identity (1,403 bp over the entire 1,407-bp fragment) with that of the type strain *Actinomyces graevenitzii* (CCUG27294; GenBank accession no. AJ 540309). On the basis of this result, we identified the isolate as *A. graevenitzii*.

*Actinomyces* spp. are the most common commensal anaerobic bacterium in the human oral cavity, and 6 species of this genus are considered pathogenic in humans: *A. israeli*, *A. naeslundii*, *A. odontolyticus*, *A. viscosus*, *A. meyeri*, and *A. gerencseriae* (8, 13). Pulmonary actinomycosis is well known as a cause of chronic infection, and it constitutes 15% of the total burden of actinomycosis in humans (8). The clinical features usually include low-grade inflammation with indolent advancement, which is similar to the presentation of fungal infection or lung neoplasms (8). Several reports (7, 8, 15) found that 25% to 49% of cases of pulmonary actinomycosis were suspected to be lung malignancy upon hospital admission, and the mean duration of illness before a definitive diagnosis was 2 to 6 months. A diagnosis of pulmonary actinomycosis is often confirmed by histological findings, which reflect...
chronic inflammation consisting of granulomatous change with sulfur granules (6). Bacterial confirmation of a clinicopathological diagnosis is usually obtained in <50% of cases owing to inadequate culturing techniques, previous antibiotic therapy, and bacterial overgrowth (1). Song et al. (15) found that positive culture results were obtained in only 3 of 40 cases of pulmonary actinomycosis. Thus, the diagnosis of conventional pulmonary actinomycosis requires a combination of several factors, including respiratory specimen culture, correlation with clinical and radiological features, histological findings, and response to antibiotic treatment.

In addition to these traditional actinomycotic forms, some coryneform anaerobic bacteria have also recently been assigned to the genus Actinomyces by the U.S. Centers for Disease Control and Prevention (4, 5). A. graevenitzii is a newly recognized Actinomyces sp. that was first isolated from 4 clinical human specimens in 1997 by Ramos et al. (11). It is a filamentous Gram-positive rod with no catalase production and is facultatively anaerobic with a distinct biochemical profile (11). Sarkonen et al. isolated A. graevenitzii from failed dental implant surfaces for their study on the distribution of Actinomyces spp. in 33 dental implant fixtures (12). Similar to other Actinomyces spp., A. graevenitzii is possibly a component of the oropharyngeal flora. Very little is known about the clinical features and pathogenesis of A. graevenitzii (14), and only 1 case report has described the disseminated infection of A. graevenitzii, which showed coinfection with Mycobacterium tuberculosis (16).

Our case presented different clinical features of conventional pulmonary actinomycosis, such as the rapid progression of lung lesions and the lack of specific histological features, including granulomatous change or presence of sulfur granules. Acute pulmonary coccidioidomycosis was first suspected because of the patient’s travel history to an area of coccidioidomycosis endemicity and the radiological features of multiple round shadows predominately located in the lower lobes. A histological examination of lung specimens by VATS was necessary for definite differentiation. Although the pathogen could not be identified by histological examination, the quantitative culture of BALF yielding 1 × 10^4 CFU/ml organisms supports the diagnosis of infection by A. graevenitzii as the etiological pathogen present in the patient’s lesions. Quantitative culturing of BALF is one of the most reliable methods for differentiating respiratory tract pathogens from colonization related to pneumonia, particular for organisms that can colonize the respiratory tract (2, 10). Because the progression of the lung lesions in our case was more rapid than that of conventional pulmonary actinomycosis, the histological findings revealed acute inflammatory change, which is different from the features of typical pulmonary actinomycosis. As our patient was a 32-year-old previously healthy woman with no known predisposing conditions, the rapid growth of pulmonary actinomycosis in our case was assumed to be due to pathogenic factors rather than host factors. Interestingly, the strain of A. graevenitzii isolated in our case formed molar-tooth-like colonies within 48 to 96 h of incubation. Its growth rate is faster than that of other Actinomyces spp. that can be cultured anaerobically for up to 3 weeks (17). We presume that the rapid growth of A. graevenitzii in aerobic conditions may contribute to rapidly progressive pneumonia. However, the reason for the rapid growth of the pulmonary lesion in this patient is unknown.

To our knowledge, this is the first report describing multiple lung abscesses caused by A. graevenitzii, which was diagnosed using a quantitative culture of BALF.

In our patient, a PET examination before treatment revealed that the lesions were located only in the lungs. Combined with the onset of clinical manifestation after inhalation of dust on a U.S. beach, it could be considered that the pulmonary multiple abscesses were caused by the entry of the pathogens to the lungs via the respiratory tract as opposed to hematogenous infection. As the habitat of A. graevenitzii is unknown, further caution is necessary for this organism, in particular when differentiation of such cases is required from those of acute pulmonary abscesses developing after the inhalation of soil, such as in cases of acute pulmonary coccidioidomycosis.

In conclusion, we report a unique case of lung abscesses caused by A. graevenitzii that resembled pulmonary coccidioidomycosis in its clinical features and CT findings. Because of its rarity, the documentation of more cases is required to define the pathogenesis of A. graevenitzii.

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REFERENCES