CASE REPORT

Pulmonary Actinomycosis Caused by *Actinomyces cardiffensis*

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Abstract

We herein present the first case of pulmonary actinomycosis caused by *Actinomyces cardiffensis* (*A. cardiffensis*). A computed tomography (CT) examination revealed a nodule with cavitation in the left upper lobe of the lung. One month later, the lesion had almost disappeared, but a new nodule with peripheral consolidation had appeared in the right middle lobe. Because organizing pneumonia was suspected, prednisolone was begun and improvement was seen. However, two months after the initiation of corticosteroid administration, a chest CT scan showed a lung abscess. The patient underwent surgical resection of the abscess. *A. cardiffensis* was identified by an amplified 16S ribosomal DNA restriction analysis of a pus sample.

Key words: pulmonary actinomycosis, *Actinomyces cardiffensis*, amplified 16S ribosomal DNA restriction analysis

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Introduction

*Actinomyces* species (sp.) are higher prokaryotic bacteria belonging to the family Actinomycetaceae. *Actinomyces israelii*, *Actinomyces naeslundi*, *Actinomyces odontolyticus*, *Actinomyces viscosus*, *Actinomyces meyeri*, and *Actinomyces gerencseriae* are all thought to cause disease in humans (1). Furthermore, in recent years, numerous new *Actinomyces* sp., including *Actinomyces cardiffensis* (*A. cardiffensis*), have been isolated from clinical specimens (2), which are capable of causing a variety of human infections, but there have been no previous reports about pulmonary actinomycosis caused by *A. cardiffensis*.

Actinomycosis occurs worldwide, and the epidemiological, clinical, and diagnostic characteristics of pulmonary actinomycosis are well known (3). However, pulmonary actinomycosis is rare in developed countries, and the incidence of actinomycosis appears to have decreased markedly in the last three to four decades (4). Therefore, a delayed diagnosis or misdiagnosis as tuberculosis or lung cancer has often occurred. We herein present the first case of pulmonary actinomycosis caused by *A. cardiffensis*, which had an atypical clinical course that mimicked organizing pneumonia.

Case Report

A 56-year-old woman complaining of general fatigue and a low-grade fever was seen at a local hospital. A chest radiograph and computed tomography (CT) (Fig. 1a) revealed a nodule with cavitation in the left upper lobe of the lung, and she was referred to our hospital for suspected pulmonary tuberculosis. Three sputum smears were negative for *Mycobacterium tuberculosis* and the QuantiFERON-TB-2 Gold test (Cellestis Ltd., Carnegie, VIC, Australia) was also negative. Bronchoscopy of the left upper lobe yielded negative cytology from a brush specimen and negative smears for acid-fast bacilli and other bacteria. Levofloxacin (500 mg/day, p.o.) was empirically administered for five days, and the low-grade fever thereafter resolved. A subsequent aerobic culture was positive, and *Streptomyces* sp. were suspected based on morphology, however, genomic identification was not performed. Although the patient had dental car-
ies, there was no apparent present illness or past medical
history of conditions such as apoplexy or neurodegenerative
diseases causing silent aspiration, gynecological systemic
diseases, or digestive diseases. One month after the levoflox-
acin treatment, the cavitary lesion in the left upper lobe had
almost disappeared on chest CT (Fig. 1b), but a new nodule
with peripheral consolidation had appeared in the right mid-
dle lobe (Fig. 1c).

Because organizing pneumonia was suspected, predniso-
lone at 40 mg/day (1 mg/kg, p.o.) was begun, and two
weeks later, an improvement was seen on the chest CT find-
ings (Fig. 1d). Corticosteroid administration was therefore
continued and tapered to 5 mg per 14 days. Two months af-
ter the initiation of corticosteroid administration, the patient
complained of the chronic production of bloody sputum and
a low-grade fever. A CT scan (Fig. 1e, f) showed a progres-
sion of the lesion in the middle lobe with the development
of a lung abscess. The patient was hospitalized. Meropenem
(1,500 mg/day) and minocycline (200 mg/day) were admin-
istered intravenously to treat Streptomyces sp., but there was
no clinical improvement, and she underwent a surgical re-
section of the right middle lobe. Macroscopically, the inside
of the lesion was filled with pus. A histopathological evalua-
tion revealed clumped Gram-positive rods (Figs. 2, 3) in
the bronchi, and severe organizing pneumonia was observed
around the peripheral lesion. A. cardiffensis was identified
by an amplified 16S ribosomal DNA (rDNA) restriction
analysis of a pus sample. We diagnosed the case as a lung
abscess caused by A. cardiffensis, although both A. cardiff-
ensis and other anaerobic bacteria had been negative in cul-
tures of a pus sample. After surgery, the patient was dis-
charged without antibiotics.

Discussion

This is the first case of pulmonary actinomycosis caused
by A. cardiffensis. A. cardiffensis is a novel species that was
first described in 2002 (2). It has been isolated from human
clinical specimens, including pleural fluid, brain, jaw, peric-
olic and ear abscesses, the gastric antrum, and intrauterine
contraceptive devices. There is little knowledge about its
colonization. In the present case, A. cardiffensis might have
come from dental caries.

Likewise, pulmonary actinomycosis is difficult to diagnose because of the nature of the clinical symptoms, and because the radiographic findings are nonspecific. The most common clinical presentation of pulmonary actinomycosis is an indolent, slowly progressive process that involves some combination of the pulmonary parenchyma and pleural space. Chest pain, fever, weight loss, and, less commonly, hemoptysis are prominent symptoms, and cough, when present, is variably productive (4). The typical CT feature of pulmonary actinomycosis is a chronic segmental air-space consolidation containing necrotic low-attenuation areas with frequent cavity formation (5), which was consistent with the radiographic findings of the present case (Fig. 1e, f).

The diagnosis requires the microscopic identification of sulfur granules in specimens, positive culture results, correlations with the clinical and radiographic findings, and a response to antibiotic therapy. In the present case, surgical resection was very useful for the diagnosis and treatment of the patient. It was initially difficult for us to diagnose this condition because the radiographic findings mimicking organizing pneumonia, the patient had an initial good response to corticosteroid treatment, and a poor response to meropenem and minocycline treatment, which is an atypical response for pulmonary actinomycosis caused by common Actinomyces sp. An amplified 16S rDNA restriction analysis (6) was very useful for the diagnosis of pulmonary actinomycosis, and this method will be essential for the diagnosis of actinomycosis in the future. The primary lesion of the left upper lobe could have been diagnosed as pulmonary actinomycosis caused by A. cardiffensis using this method.

Experience with more cases of pulmonary actinomycosis caused by A. cardiffensis and more information on this organism are obviously needed, however, respiratory physicians should be aware of this disease when investigating patients for persistent pulmonary shadows. In cases where actinomycosis is suspected, physicians should immediately perform an amplified 16S rDNA restriction analysis, which might lead to an earlier diagnosis of the disease and could avoid the need for surgery.

**The authors state that they have no Conflict of Interest (COI).**

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**References**