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ID CASES

A 79-Year-Old Man With Chronic Aspiration and an ^{18}F-Fluorodeoxyglucose-Positron Emission Tomography/Computerized Tomography Positive Lung Mass

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CASE PRESENTATION

A 79-year-old man with a history of diabetes mellitus presented with a chronic productive cough associated with food intake and unintentional weight loss of 6 pounds in the prior month. He denied fever, chills, night sweats, or pleuritic chest pain. He had smoked 2 packs of cigarettes per day for over 30 years. Physical examination was unremarkable. Chest x-ray showed a right upper lobe pulmonary lesion. Computerized tomography (CT) scan of the chest showed extensive mass-like consolidative changes with associated volume loss in the right upper lobe (Figure 1). Positron emission tomography (PET)-CT scan showed abnormal fluorodeoxyglucose (FDG) uptake in the entire lesion, most marked within the pulmonary apex (Figure 1). The patient underwent bronchoscopy with bronchoalveolar lavage and transbronchial biopsy of the right upper lobe. The right lung biopsy showed organic vegetable matter with associated suppurative inflammation, necrosis, and Gram-positive filamentous bacterial colonies (Figure 2). These organisms stained positive by Gram and silver stain, but were negative by Fite stain.

Bronchoalveolar lavage fluid cultures grew *Actinomyces graevenitzii*, identified by partial 16S ribosomal ribonucleic acid (RNA) gene sequencing. The isolate was susceptible to penicillin and clindamycin. A diagnosis of pulmonary actinomycosis was made based on clinical presentation, histopathology findings, and culture. The patient improved clinically on high-dose, intravenous penicillin therapy. Penicillin was switched to clindamycin after a few days due to the development of a rash. Repeat CT scan of the chest after 8 weeks of antibacterial therapy showed significant improvement in the right upper lobe consolidative process (Figure 3).

DISCUSSION

Actinomycosis is an indolent, endogenous infection that commonly affects the cervicofacial, pulmonary, or abdominopelvic regions and is caused by *Actinomyces* species [1]. The isolation of *Actinomyces* species from mucosal surfaces in the absence of clinical or histopathological abnormalities consistent with actinomycosis is of little clinical significance because they are part of the human commensal microbiota and are known to colonize the oral cavity, gastrointestinal, and genitourinary tracts [1]. Pulmonary actinomycosis is most prevalent in older men and is associated with aspiration and poor dental hygiene [2]. Classic actinomycosis has become rare, perhaps due to the early administration of antibacterial therapy and improved dental hygiene. Depending on the site of infection, companion organisms are commonly coisolated [3]. A frequent association with foreign objects (eg, pelvic actinomycosis and intrauterine contraceptive devices, pulmonary actinomycosis, and foreign body aspiration) suggests growth facilitation by biofilm formation [4].

Diagnosis may be challenging due to the nonspecific nature and chronicity of symptoms. Pulmonary actinomycosis often mimics malignancy due to its mass-like features, slow progression, spread across tissue planes, propensity to cause intense FDG uptake on PET scan, and lack of response to short courses of antibacterial therapy [1, 5, 6]. In a series of 5 patients with histopathologically proven pulmonary actinomycosis, 4 of 5 (80%) patients showed increased FDG uptake in their lung lesions on ^{18}F-FDG PET scan [5]. Most cases are diagnosed based on clinical and histopathological findings. Classic histopathological findings include the presence of sulfur granules, which are colonies of organisms arranged in round or oval basophilic masses surrounded by radiating eosinophilic terminal clubs on hematoxylin and eosin staining (see Figure 2) [2, 6]. Aggregates of branching, filamentous delicate bacilli that stain positive on Gram and silver stain, but negative on the modified acid-fast Fite stain are visible at the periphery of the sulfur granules (Figure 2) [7]. Modified acid-fast (Fite) stain may help differentiate the

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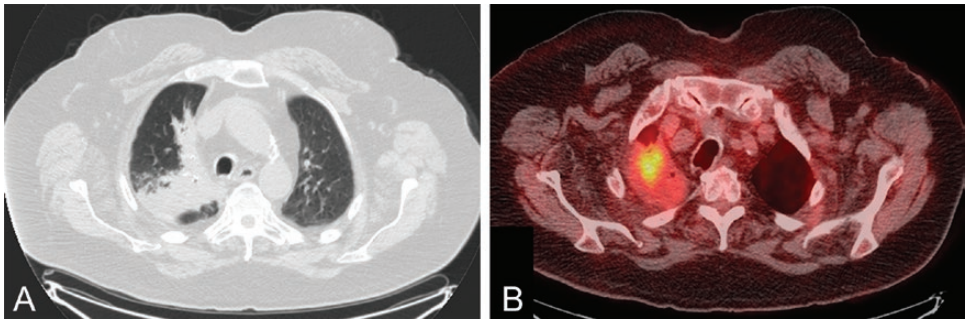

Figure 1. Computerized tomography (CT) scan of the chest showing extensive mass-like consolidative changes in the right upper lobe (A). Positron emission tomography-CT scan showing abnormal fluorodeoxyglucose uptake in the entire lesion, most marked within the pulmonary apex (B).

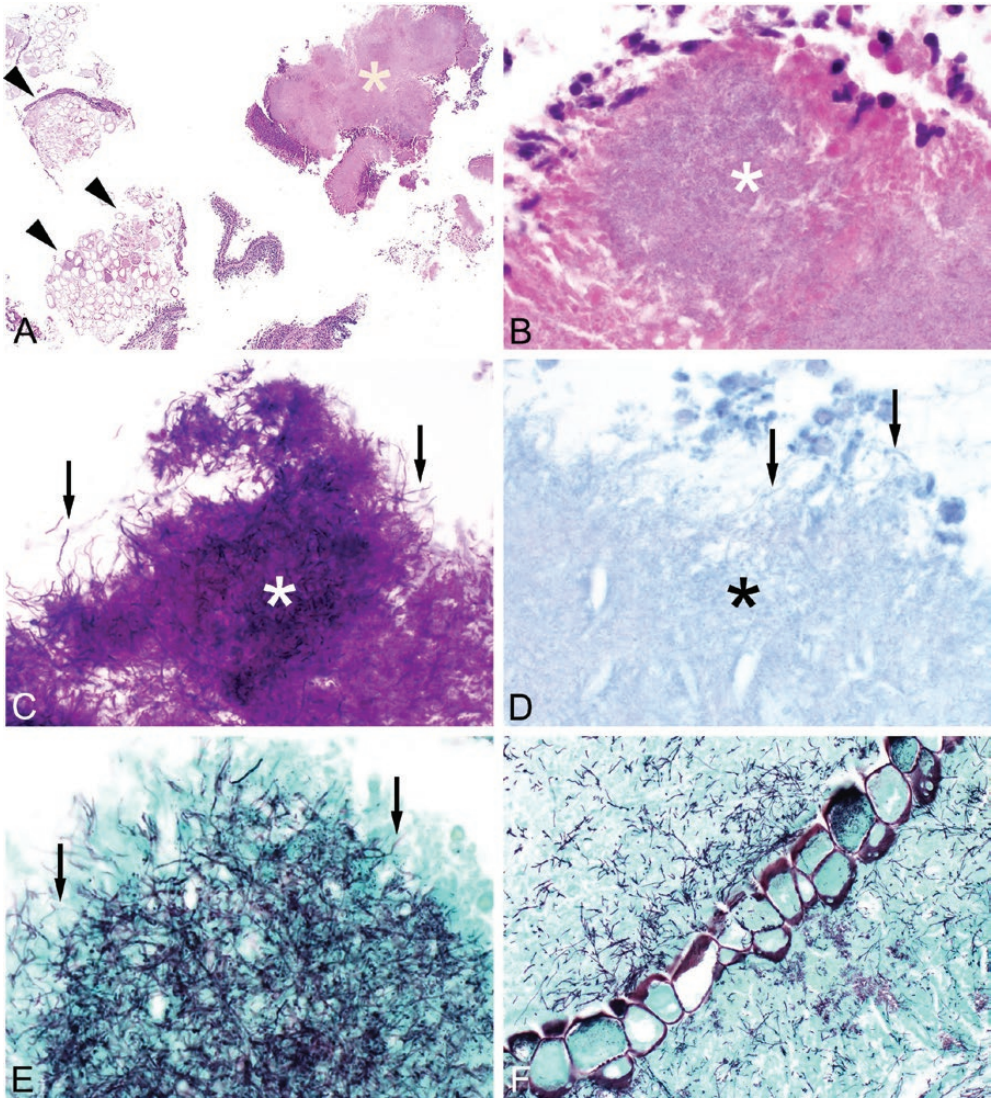

Figure 2. Right lung biopsy specimen: at low magnification (A, hematoxylin and eosin stain [H&E], 20×), fragments of organic vegetable matter (arrowheads) are seen in close proximity to a sulfur granule (*). The granular nature of the sulfur granule (asterisk) can be better appreciated at higher magnification (B, H&E, 1000×). The individual Gram-positive filamentous bacteria that comprise the sulfur granule are highlighted using the tissue Gram stain (C, 1000×) and are negative using the modified acid-fast (Fite) stain (D, 1000×). Gomori methenamine silver stain also highlights the filamentous branching bacteria forming the sulfur granule (E, 1000×, arrows) and demonstrates the close association between the bacteria and organic vegetable matter (F, 400×).

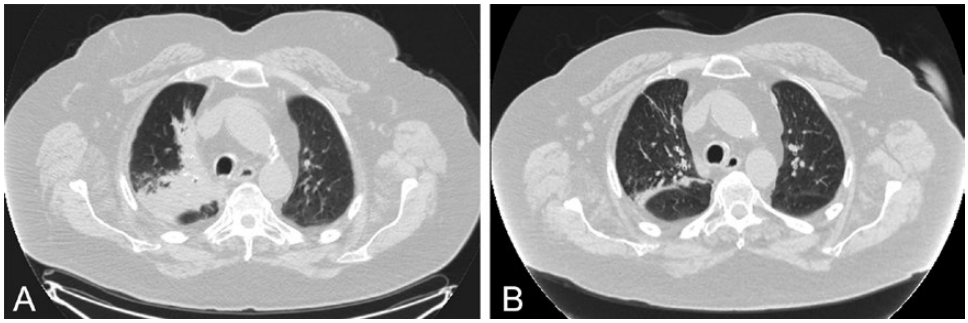

Figure 3. Computerized tomography (CT) scan of the chest done after 8 weeks of antibacterial therapy showing significant improvement in the right upper lobe consolidative process (B) compared with the pretreatment CT scan of the chest (A).

filamentous bacterium, *Nocardia* species, from *Actinomyces* species because only the former are partially acid fast. Occasionally, the Splendore-Hoeppli phenomenon (eosinophilic, proteinaceous coating) may be observed surrounding actinomycotic granules [8]. The microbiology laboratory should be notified if actinomycosis is suspected. Anaerobic transport media and anaerobic incubation for up to 14 days are essential for optimal isolation of *Actinomyces* species. Some laboratories, such as ours, offer a specific orderable test, *Actinomyces* culture. Notably, a single dose of an antibiotic may interfere with isolation in cultures. Matrix-assisted laser desorption ionization time-of-flight mass spectrometry and 16S ribosomal RNA gene polymerase chain reaction/sequencing provide accurate identification of *Actinomyces* species [6].

Complications of pulmonary actinomycosis include extension across tissue planes to adjacent pulmonary lobes, the mediastinum, pleura, vertebral body, and the thoracic chest wall, often forming a soft tissue mass or draining sinus (empyema necessitans) [6, 7]. Despite inherent resistance to metronidazole, the agents of actinomycosis are highly susceptible to many antibacterial agents. Treatment is often individualized and has historically involved the administration of high-dose parenteral penicillin for 2 to 6 weeks followed by 6 to 12 months of oral penicillin. For patients allergic to penicillin, tetracycline or clindamycin may be used [2, 6].

CONCLUSIONS

Despite being an easily treatable disease with a high cure rate, early diagnosis of pulmonary actinomycosis is often missed. Correction of underlying predisposing risk factors (eg, improved dental hygiene, prevention of recurrent aspiration) is vital to prevent recurrence of infection.

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Potential conflicts of interest. All authors: No reported conflicts.

All authors have submitted the ICMJE Form for Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

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