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Case report

A case of relapsed lung abscess caused by *Eubacterium brachy* infection following an initial diagnosis of pulmonary actinomycosis

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ABSTRACT

We report a rare case of lung abscess due to *Eubacterium brachy*. In this case, an analysis of the aspirate from frank pus revealed Gram-positive coccobacilli. We initially strongly suspected lung abscess associated with actinomycosis because of the chronic/recurrent clinical course and radio-pathological findings such as a granuloma lesion. Although a biochemical analysis revealed *Actinomyces* sp., 16S rRNA gene sequencing and a phylogenetic tree analysis of the isolated strain confirmed the presence of *E. brachy*. Some cases previously diagnosed as actinomycosis might be correctly diagnosed as *E. brachy* infection. Clinicians should be aware that additional studies using 16S rRNA gene sequencing are needed to clarify whether pulmonary infection associated with *E. brachy* is a similar entity to that of chronic granulomatous infection disease in pulmonary actinomycosis.

1. Introduction

Eubacterium brachy is a bacterial species of non-saccharolytic anaerobic Gram-positive coccobacilli that is frequently isolated from human oral lesions [1]. The present patient was initially diagnosed as having lung abscess due to actinomycosis. Afterwards, additional analysis with 16S ribosomal RNA (16S rRNA) gene sequencing confirmed the presence of *E. brachy* as the causative agent in this case. We report this valuable case because there are few reports of lung abscess associated with *E. brachy*, and the pathogenesis of this organism is poorly understood.

2. Case report

A 40-year-old non-smoking Japanese man who drank socially complained of cough and slight fever and was diagnosed at another hospital as having pneumonia. His chest X-ray revealed a shadow in the upper-middle left lung lobe (Fig. 1A). His past medical history included a spontaneous pneumothorax of the left lung at 30 years old. He improved over 7 days with oral administration of the antibiotic cefditoren pivoxil. Afterward, he was asymptomatic for the next two months, and although the infiltration on his X-ray had gotten better, it did not continue to improve (Fig. 1B). Therefore, bronchoscopy with *trans*-bronchial lung biopsy was performed that showed inflammatory cells, noncaseating epithelioid granulomas, and multinucleated giant cells in the interstitial lung space (Fig. 2). No organisms (e.g., mycobacteria or fungi) were identified by culture and histological methods such as Ziehl-Neelsen, Grocott, and PAS staining. At a follow-up examination a further two months later, the infiltration on his chest X-ray had deteriorated (Fig. 1C), and he was then transferred to our hospital. His vital signs were temperature, 37.1 °C; blood pressure, 123/75 mmHg; pulse, 88 beats/min with regular rhythm; and oxygen saturation on room air, 97% via pulse oximetry sensor. His oral condition was poor, and he had some decayed teeth. The patient's erythrocyte sedimentation rate was elevated at 82 mm/hour, and his C-reactive protein level was 3.2 mg/dL. His white blood count was 8150/mm^3 (74.6% neutrophils, 14.5% lymphocytes), and his HbA1c (NGSP: National Glycohemoglobin Standardization Program) level was 4.8%. There were also disorders of the patient's renal and liver functions. The titers of β-D-glucan, *Aspergillus* antigens, *Aspergillus* precipitating

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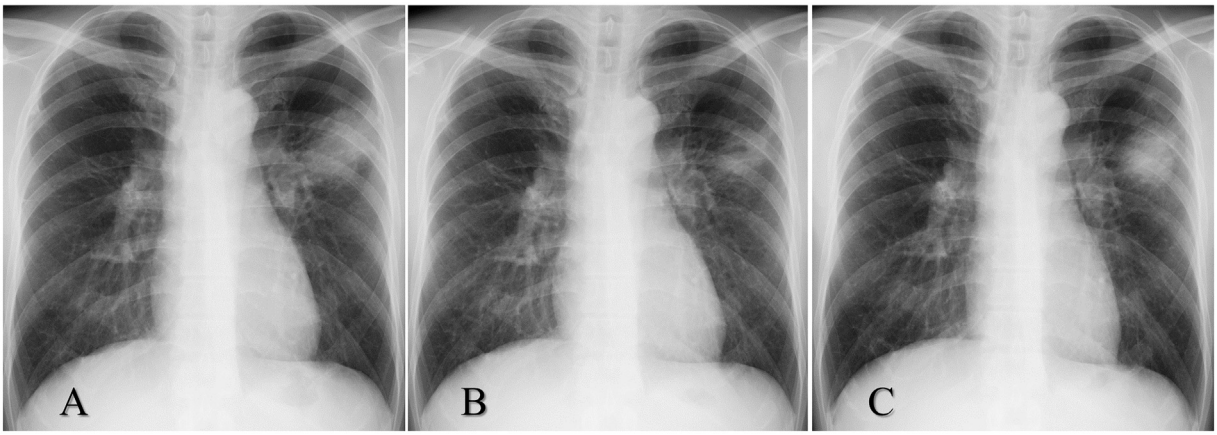

Fig. 1. Radiological course. **(A)** Chest X-ray obtained 4 months before transfer to our hospital showed infiltration in the left upper-middle lung. **(B)** Two months later, although the infiltration on his X-ray had gotten better, it did not continue to improve. **(C)** Two months after this, the infiltration had re-expanded on transfer to our hospital.

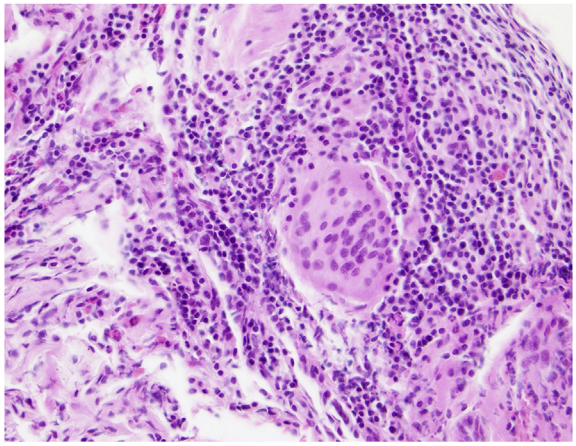

Fig. 2. Histological images of transbronchial lung biopsy specimen revealed inflammatory cells, noncaseating epithelioid granulomas, and multinucleated giant cells in interstitial lung space (hematoxylin and eosin stain, ×200).

antibodies, *Cryptococcus* antigens, and anti-HIV-antibodies were all negative. Chest contrast-enhanced computed tomography (CT) revealed a left lung mass lesion crossing a fissure with a central area of low attenuation (Fig. 3A–B). Contrast-enhanced whole-body CT showed no other lesions, and transthoracic echocardiography showed no evidence of infective endocarditis. Lung tissue obtained by percutaneous needle biopsy under CT guidance showed chronic inflammatory change, but these pathological findings were non-diagnostic. However, fluid aspirated from the lung mass showed frank pus, and Gram staining of this specimen revealed Gram-positive coccobacilli and Gram-negative cocci/rods (Fig. 4). The Gram-positive coccobacilli were identified as *Actinomyces* sp. by biochemical identification. The other organisms could not be axenically cultured. He was diagnosed as having lung abscess due to actinomycosis, and after the patient received amoxicillin for two months, his abnormal lung shadow improved (Fig. 3C). Subsequently, 16S rRNA gene sequencing and a phylogenetic tree analysis of the specimen (initially identified *Actinomyces* sp.) confirmed the presence of *E. brachy* (Fig. 5). There has been no recurrence for 7 months after antibiotic therapy, and his follow-up examination is considered complete.

3. Discussion

In this patient, we initial strongly suspected a lung abscess associated with actinomycosis because of the patient's chronic and recurrent clinical course and his radio-pathological findings.

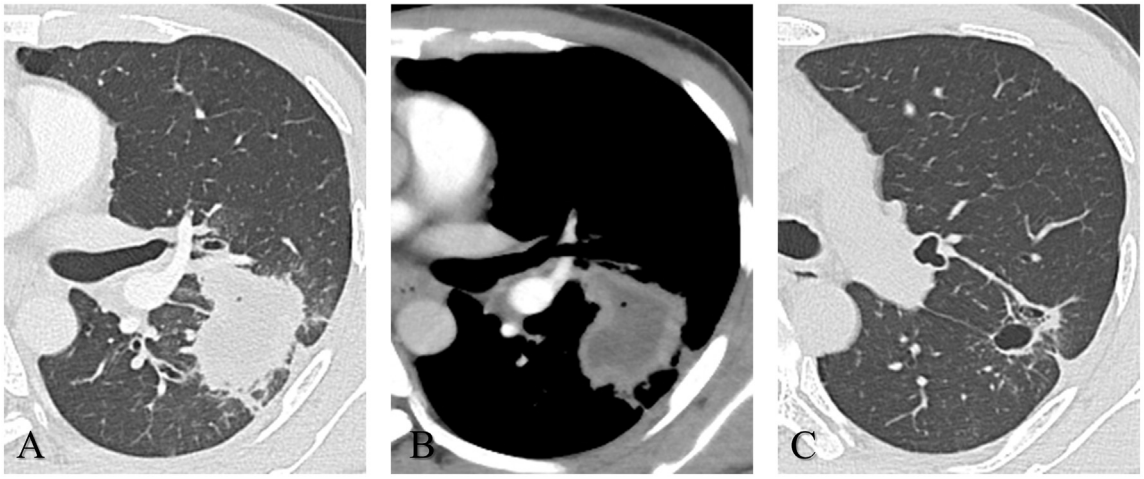

Fig. 3. **(A/B)** Chest computed tomography on transfer to our hospital showed low attenuation within consolidation in the left lung, which was crossing a fissure. **(C)** After the patient received antibiotic therapy for two months, his abnormal lung shadow showed apparent improvement.

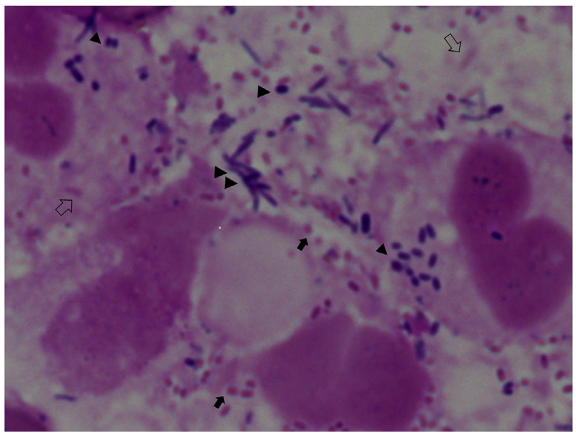

Fig. 4. Microscopic findings of aspirated frank pus showed Gram-positive coccobacilli (arrowheads) and Gram-negative cocci (closed arrows) and bacilli (open arrows) (×1000).

Although a biochemical analysis of the aspirate from the lung abscess revealed *Actinomyces* sp., 16S rRNA gene sequencing and a phylogenetic tree analysis of the isolated strain confirmed the presence of *E. brachy*.

E. brachy is a Gram-positive coccobacillus that is found primarily in subgingival samples taken from patients with periodontitis [1–4]. This pathogen can also cause pleuropulmonary infection [5]. However, only two previous cases have been reported as pleuropulmonary infection associated with *E. brachy*, so the role of *E. brachy* in the pathogenesis of infection is poorly understood [1,5]. Bacterial pneumonia and lung abscess in adults are the result of the aspiration of oropharyngeal flora into the lower respiratory tract and failure of host defense mechanisms to eliminate the contaminating bacteria, which multiply in the lung and cause infection. It is recognized that lung abscesses can be the result of infection by anaerobic bacteria; thus, dental plaque would seem to be a logical source of these bacteria, especially in patients with periodontal disease [6]. Therefore, we thought the possibility that *E. brachy* from subgingival areas in association with periodontitis might be a more highly likely concern for lung abscess in this patient.

Actinomycosis is a chronic granulomatous condition that commonly manifests as cervicofacial, pulmonary, or abdominal disease that is caused by slowly progressive infection with oral and gastrointestinal commensal *Actinomyces* species [7]. In its clinical course, most clinical signs of *Actinomyces* infection are nonspecific, and often, the patient is relatively asymptomatic [8]. Short-term antibiotic treatment may induce the possible recurrence of *Actinomyces* infection as in our case [7,9]. The typical CT feature of pulmonary actinomycosis is a chronic segmental air-space consolidation containing necrotic areas of low-attenuation with frequent cavity formation and peripheral enhancement [10]. Because our patient had a predisposing factor (i.e., poor oral hygiene) for lung abscess and the above features including his clinical course and radio-pathological findings, we diagnosed him as having pulmonary actinomycosis by culture results via a biochemical method. However, this organism was actually identified later as *E. brachy* by 16S rRNA gene sequencing.

Characteristics of both *Actinomyces* sp. and *E. brachy* are slow and minimal anaerobic growth, which could result in failure to culture [1,7]. Even if it is isolated, because *E. brachy* is poorly characterized, this organism cannot be identified by commercially based biochemical identification [1,5]. In fact, biochemical identification of our patient's organism could not accurately isolate it as a species of *Actinomyces*. Therefore, molecular analysis such as that with 16S rRNA gene sequencing may provide accurate diagnosis of *E. brachy* infection, including in some cases in which *Actinomyces* species was previously identified by conventional biochemical identification methods. However, these bacteria were almost always present with other species in infections [1,5,7,11]. Although some Gram-positive bacteria were found in the aspirated pus of our patient, bacteria other than *E. brachy* could not be isolated. Thus,

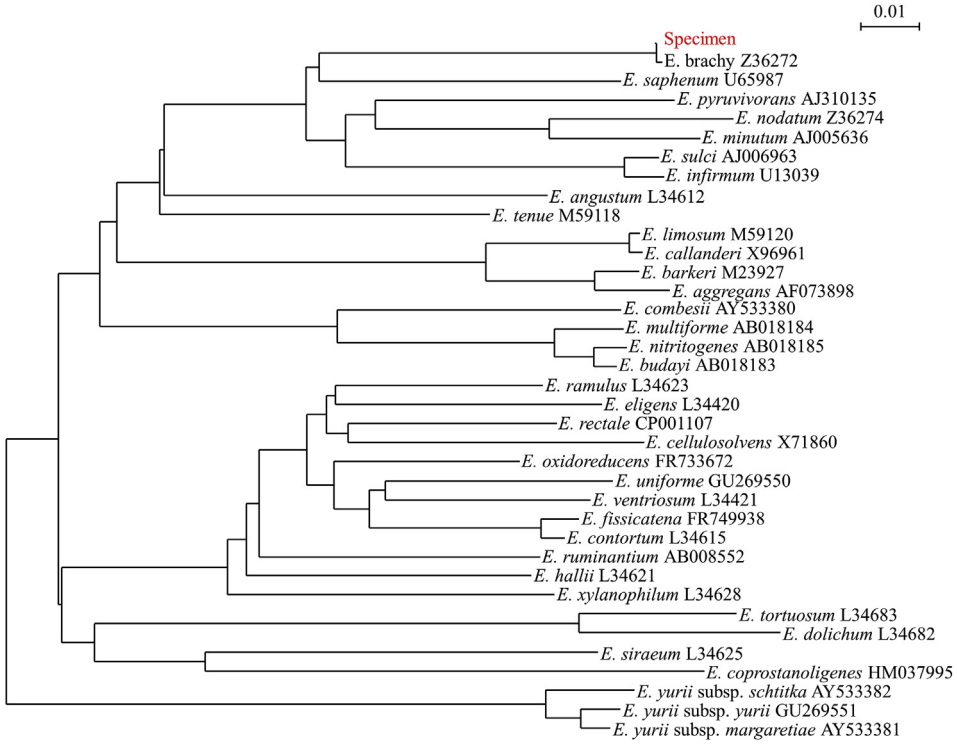

Fig. 5. Neighbor-joining tree of the genus *Eubacteria* based on 16S rRNA gene sequences.

additional studies are needed to clarify whether pulmonary infection associated with *E. brachy* itself is a similar entity of chronic granulomatous infection disease in pulmonary actinomycosis.

E. brachy is usually susceptible to most antibiotics [5]. However, *Actinomyces* spp. are usually extremely susceptible to beta-lactams, and especially penicillin G or amoxicillin [8,9]. Our patient received amoxicillin for two months according to therapy for actinomycosis and then improved without recurrence. If clinicians can diagnose a lung abscess as being due to *E. brachy* rather than *Actinomyces* sp., short-term antibiotic treatment may be adequate duration of treatment unlike that required for actinomycosis. The optimal time after which the efficacy of treatment for *E. brachy* should be evaluated is not known.

In conclusion, we experienced a rare case of relapse of a lung abscess due to *E. brachy* infection diagnosed by 16S rRNA gene sequencing and a phylogenetic tree analysis. We believe that a combined biochemical and molecular approach is important to clarify the true incidence and detailed pathogenesis of the pleuropulmonary infections associated with both *Actinomyces* and *E. brachy*.

Conflict of interest statement

The authors declare no Conflicts of Interest (COI) in association with this article.

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