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Mycobacterium phocaicum and *Mycobacterium avium-intracellulare* in a patient with hot tub lung

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Abstract

A 77-year-old woman who used her spa pool at least twice a day to relieve pain from osteoarthritis, developed progressive breathlessness, impaired pulmonary function, and radiographic changes consistent with hypersensitivity pneumonitis-like lung disease. *Mycobacterium avium-intracellulare* complex (MAC) was cultured from bronchoalveolar lavage fluid. Transbronchial biopsies revealed non-necrotizing granulomatous inflammation. Sputum and spa pool water cultured *Mycobacterium phocaicum* but not MAC. She stopped using the spa pool and was treated with oral prednisone, which led to symptomatic, pulmonary function, and radiographic improvement. This is the first case of hypersensitivity pneumonitis-like granulomatous lung disease associated with exposure to *M. phocaicum* in spa pool water.

Introduction

Hypersensitivity pneumonitis-like disease due to exposure to nontuberculous mycobacteria in spa pool water is also known as "hot tub lung." We report a case of hot tub lung in a patient who had *Mycobacterium phocaicum* and *Mycobacterium avium-intracellulare* cultured from respiratory tract samples.

Case Report

In February 2010, a 77-year-old New Zealand European woman was admitted to hospital with 10 months of progressive shortness of breath. She had troublesome osteoarthritis in her knees and used an indoor spa pool two to four times a day to relieve the discomfort. She had never smoked, did not own pets, and had no significant history of travel. Physical examination revealed bilateral crackles in the lung bases. Oxygen saturation was 89% on air and 95% on 2 l/min of oxygen. Initial chest radiography showed diffuse, bilateral, interstitial changes. High-resolution computed tomography (HRCT) showed patchy ground glass opacification throughout both lungs with upper lobe predominance (Fig. 1A). Pulmonary function tests showed forced expiratory volume in 1 sec (FEV1) 1.6 l (87% predicted), forced vital capacity (FVC) 2.3 l (85% predicted), total lung capacity (TLC) 4.73 (99%), and diffusing capacity of lung for carbon monoxide (DLCO) 13.9 ml/mmHb/min (80%). Serologic testing for collagen vascular diseases and vasculitides was negative. Transbronchial lung biopsies showed non-necrotizing granulomatous inflammation (Fig. 2). Auramine-rhodamine smears of bronchoalveolar lavage fluid were negative for acid fast bacilli, but *M. avium-intracellulare* complex (MAC) was isolated after 10 days of incubation and identified using a DNA probe (AccuProbe, Gen-Probe, San Diego, CA, USA). Subsequent spontaneous sputum smears revealed 2+ acid fast bacilli (one to nine organisms per 10 high-power fields), and a

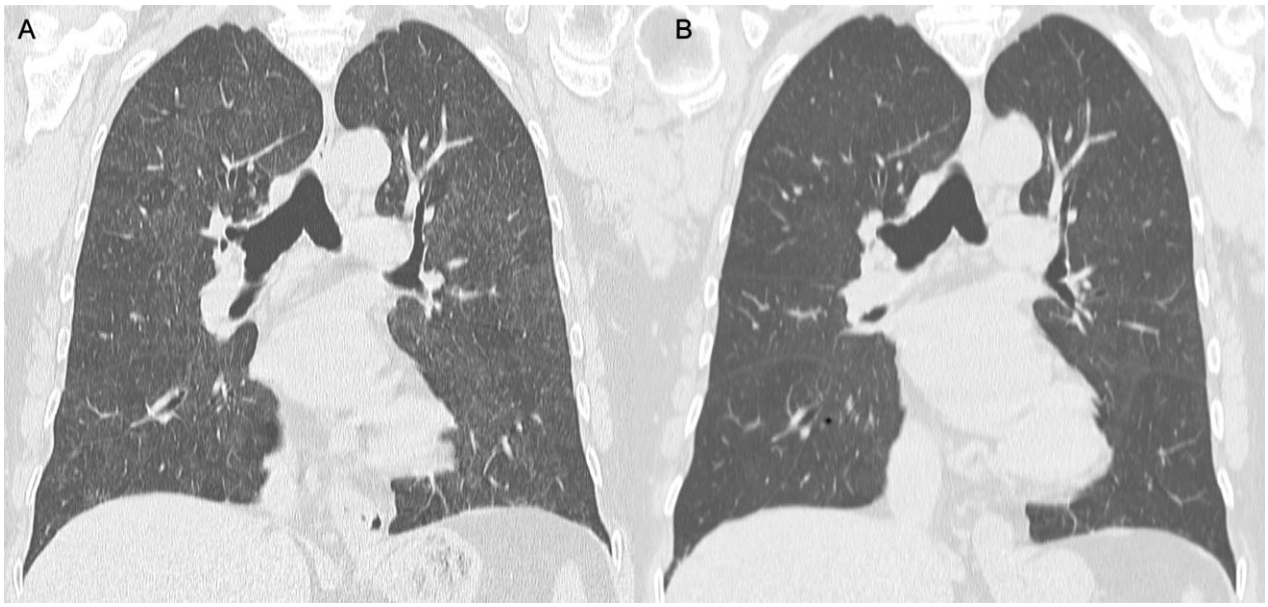

Figure 1. Chest computed tomography (CT) scans in a patient with hypersensitivity-like pneumonitis. (A) CT scan at presentation showing patchy ground glass opacification throughout both lungs with soft centrilobular nodules at the lung apices. (B) Complete resolution after treatment with oral steroids and avoidance of spa pool water.

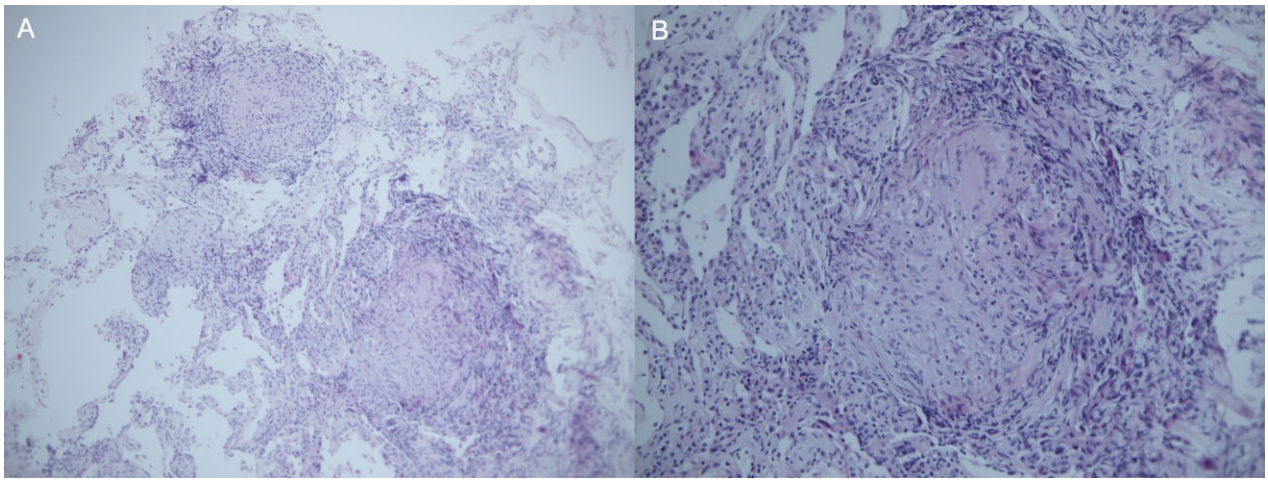

Figure 2. Transbronchial lung biopsies demonstrating non-necrotizing granulomata and thickened interstitium with an associated interstitial inflammatory response. Hematoxylin–eosin staining (A) 100× magnification. (B) 200× magnification.

nontuberculous mycobacterium was isolated after 6 days of incubation. This isolate was MAC DNA probe negative. Around this time a sample of the patient's spa pool water was tested and a nontuberculous mycobacterium isolated after 13 days. The isolates cultured from sputum and spa pool water were referred to a reference laboratory for speciation and were both identified as *M. phocaicum* by heat shock protein (HSP) 65 gene analysis. Samples of pool water were not collected around the time of the MAC-positive BAL sample. She was advised to stop using her spa pool and treated with prednisone for a total of 7 months. Prednisone was commenced at a dose of 30 mg daily for 1 month followed by 20 mg daily for 3 months. Thereafter, prednisone was tapered off over the next 3 months. Her symptoms completely resolved over this period. Subsequently, the spa pool was removed because the risk of recurrence was thought to outweigh the benefits of bathing in the spa pool. Repeat HRCT scan of the chest in August

2010 showed complete resolution of the pneumonitis (Fig. 1B). Lung function tests in February 2011 showed improved lung function with FEV1 1.99 l, FVC 2.78 l, TLC 5.34 l and DLCO 16.7 ml/mmHb/min.

Discussion

Hot tub lung is primarily associated with exposure to *M. avium-intracellulare*, but cases of this condition related to *M. fortuitum* have also been reported. It is thought to be due to a hypersensitivity response to mycobacterial antigens. Infection has also been proposed to have a role in its pathogenesis but this notion remains contentious [1]. Because the pathogenesis of hot tub lung remains poorly understood, it has been termed "hypersensitivity-like disease" [2]. Most patients respond to avoidance of further exposure to spa pool water alone or to avoidance and additional oral corticosteroid treatment. Antimycobacterial treatment does not appear to be required in the management of this condition [3].

M. phocaicum is a rapidly growing mycobacterium that was first described in 2006 [4]. It is indistinguishable from *M. mucogenicum*, another rapidly growing mycobacterium, by 16s rRNA gene sequence analysis but is able to be differentiated by rpoB gene or HSP 65 gene sequence analysis. Since it was discovered in 2006, nine cases of catheter-related bacteremia have been reported [5–7]. *M. phocaicum* has also been isolated from respiratory secretions and associated with the development of chronic pneumonia, although the clinical details have not been formally reported [4].

Both *M. phocaicum* and *M. avium-intracellulare* were identified in our patient at different times. Although the development of pneumonitis may have been caused by either or possibly both organisms, we believe that *M. phocaicum* was involved in this patient's illness because *M. phocaicum* was isolated from both sputum and spa pool water, and sputum smears were positive (indicating high numbers of mycobacteria). Environmental contamination usually involves small numbers of organisms and rarely results in a positive smear examination [2]. Furthermore, it is possible that *M. phocaicum* was also present in the bronchoalveolar lavage specimen that cultured *M. avium-intracellulare* but was not identified. In our laboratory, once a sample is positive for any mycobacterium, the broth culture is not incubated further. Therefore, if *M. phocaicum* was present in the first sample but a slower grower than *M. avium-intracellulare*, it would not have been cultured and referred for identification by HSP 65 gene analysis.

This is the first case of hypersensitivity pneumonitis-like granulomatous lung disease associated with exposure to *M. phocaicum* in spa pool water. Clinicians should consider this microbe in the microbiological evaluation of patients who present with clinical and radiological features of hypersensitivity pneumonitis.

Disclosure Statements

No conflict of interest declared.

Appropriate written informed consent was obtained for publication of this case report and accompanying images.

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