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Case report

Mycobacterium chimaera infection masquerading as a lung mass in a healthcare worker

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ABSTRACT

Mycobacterium chimaera, a nontuberculous mycobacterium, is a member of the *Mycobacterium avium* complex (MAC). This microorganism has recently gained significant notoriety for its association with outbreaks in patients exposed to contaminated heater –cooler devices used during open heart surgeries.

We report a case of *Mycobacterium chimaera* pulmonary infection in a healthcare worker who presented with cough, low grade fever and weight loss with evidence of a lung mass that was initially thought to be a tumor on CT scan imaging. The patient underwent partial left lung lobectomy and pathology revealed necrotizing granulomas with acid fast bacilli and a culture grew *M. chimaera*. The patient received combination antimycobacterial therapy according to susceptibility results for twelve months with complete resolution of his symptoms and radiographic findings.

Infection Control investigation could not find a source of infection in the hospital where he worked during the last ten years. However, the patient rotated in different hospitals before coming to work at this facility and assisted in surgeries in several operating rooms where the heater-cooler devices in question were used.

Case report

A 66-year-old Caucasian male Physician Assistant was evaluated at the Infectious Disease clinic for ten-pound weight loss and worsening dry cough without fevers, night sweats or hemoptysis. He had a history of controlled type 2 diabetes mellitus, hypertension, dyslipidemia and remote history of latent tuberculosis treated in 1973 with 6 months of isoniazid. He smoked one pack of cigarettes per day during his early adulthood and quit smoking more than 40 years ago. On examination, he appeared weak and anxious with a weight 83 kg that appeared appropriate for his 185-cm height. He had a normal respiratory rate of 16 per minute, pulse of 78 per minute, and a blood pressure of 127/76 mmHg. Chest auscultation revealed good breath sounds with few left upper lobe rhonchi without crackles. The remainder of his exam was normal. Laboratory work-up revealed a white blood cell count of 5600/mm3, with 53.2% neutrophils, 29.2% lymphocytes, 11.9% monocytes, 3.8% eosinophils, hemoglobin 14.3 g/dL and platelet count 219,000/mm [3]. The comprehensive metabolic panel was within normal limits and his HIV 1/2 antibody screen was negative.

Chest CT scan showed left upper lung lobe mass measuring $3.1 \times 2.6 \times 2.2$ cm with smaller lower lobe lung nodules and mild left hilar adenopathy (Fig. 1). PET scan followed with findings concerning for malignancy. However, CT guided FNA biopsy was done and showed no evidence of malignant cells with negative routine, fungal and mycobacterial cultures. The patient was referred to cardiothoracic surgery and underwent thoracotomy and partial lobectomy with resection of the lung mass. Pathology exam revealed necrotizing granuloma with acid fast bacilli (Fig. 2).

Mycobacterial culture grew *Mycobacterium chimaera*. Confirmation and susceptibility testing were completed at the National Jewish Medical Center Mycobacteriology Laboratory in Denver, CO with molecular probes using 16S rDNA sequencing and rpoB sequencing. The isolate showed susceptibility/ intermediately susceptibility to clarithromycin, rifabutin and ethambutol with minimum inhibitory concentrations of 4 mcg/ mL, 0.5 mcg/ mL and 8mcg/mL, respectively. It showed resistance to ciprofloxacin, moxifloxacin, linezolid and amikacin with minimum inhibitory concentrations of 16 mcg/mL, 4 mcg/mL, 64 mcg/mL and 16mcg/ mL, respectively.

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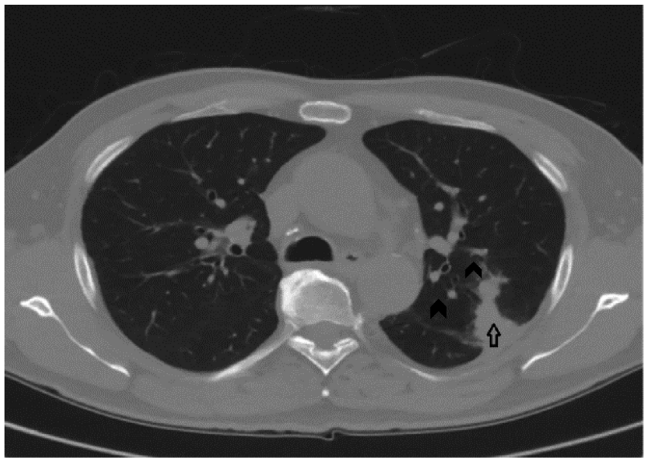

Fig. 1. Initial CT scan of the chest showing left lung mass (arrow), nodules and hilar adenopathy (arrowheads).

The patient was initially treated with a 3-drug regimen including Rifabutin, Clarithromycin and Ethambutol. He had gastrointestinal intolerance to Clarithromycin, and it had to be switched to Azithromycin after 2 months. He also developed an allergic reaction to Rifabutin 6 months into therapy in the form of drug fever and eosinophilia and the drug had to be stopped. He completed the remaining 12 months of antimycobacterial therapy with Azithromycin and Ethambutol with complete resolution of his clinical and radiologic manifestations.

Discussion

The development of more advanced and specialized molecular techniques for identification of previously unrecognized organisms has permitted the isolation of many nontuberculous mycobacteria (NTM) as human pathogens. Additionally, there has been an increasing understanding of the defects in lung structure and immune response that facilitates these infections [1]. *Mycobacterium chimaera* (*M. chimaera*) is a slow-growing acid-fast bacillus that forms unpigmented colonies. It was first isolated in 2004 as a unique subspecies pathogen from the *Mycobacterium avium* complex (MAC) that also includes *Mycobacterium avium* and *Mycobacterium intracellulare* among others [2]. Utilization of molecular probes with 16S rDNA sequencing and rpoB sequencing is essential to identify *M. chimaera* among other members of the *Mycobacterium avium* complex [6,10].

Interest in *M. chimaera* infectious potential has emerged in the recent few years as cardiac, pulmonary and disseminated infections have been reported in patients with a history of different types of cardiac surgeries. The source of infection has been identified to be LivaNova PLC (formerly Sorin Group Deutschland GmbH) Stöckert 3 T heater-cooler devices, used during many of these surgeries. Some of these devices are thought to have been contaminated during manufacturing. *M. chimaera* was isolated from the water tanks within these heater-cooler devices [3–5]. Droplets loaded with *M. chimaera* are ejected from the contaminated water tanks within these devices, spreading an infective bioaerosol with a particle size of $< 1\ \mu m$ in the operating room environment. These aerosolized droplets maybe inhaled by the patient or staff and they may also settle on surfaces forming biofilms in the operating room environment or in the patients having surgeries that involve placement of prosthetic material such as heart valves or vascular grafts [5,6,13–15].

M. chimaera growth and disease in patients are slow. Marra et al reviewed 52 patients who developed *M. chimaera* infection complicating cardiovascular surgeries. They identified a period from exposure to clinical presentation up to 6 years. Patients may present with nonspecific systemic symptoms such as fatigue, fever, sweats, and weight loss. Pulmonary symptoms include chronic cough and dyspnea [16]. Tissue specimens submitted for pathology exam usually reveal noncaseating granulomas that are rarely acid –fast bacilli smear- positive [17]. Patients may develop pulmonary infection, locally invasive infection with involvement of sternal wounds, mediastinum, and pleural space, prosthetic valve infection with endocarditis, vascular graft infection, or disseminated infection with involvement of the liver, spleen, kidneys, joints, bones and bone marrow [3–6]. Patients with prosthetic valve infection and disseminated infection may have increased mortality up to 50% [3,7,8,11].

The American Thoracic Society (ATS) and the Infectious Disease Society of America (IDSA), recommend combination antimycobacterial therapy with clarithromycin, rifampin and ethambutol for patients with disseminated *Mycobacterium avium* complex infection [9]. Specific treatment regimens for patients with *M. chimaera* infection have not been recommended and will need to be outlined based on future clinical outcomes. As with other *Mycobacterium avium* complex species, *M. chimaera* infection is usually treated with a prolonged course of Clarithromycin, Ethambutol, and Rifampin. Severe disease may require additional antibiotic therapy with aminoglycosides [12].

Our patient likely contracted his *M. chimaera* in healthcare facilities where he rotated and worked in their operating rooms prior to being recruited in our facility. During his ten-year work history at our facility, he provided patient care in a pre-operative clinic without attending any operating rooms. Furthermore, our facility has not provided open heart surgeries and never carried above named heater-cooler devices that are potentially contaminated. However, we verified that the other facilities where the patient worked in their operating rooms before ten years provided open heart surgeries and used the heater-cooler devices in question.

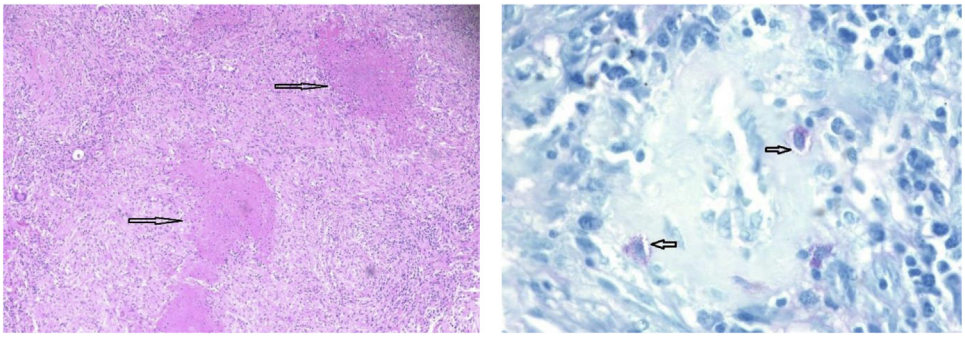

Fig. 2. *Left;* Lung Mass Tissue Biopsy with H&E stain showing necrotizing granuloma is present on a fibrotic background. *Right;* Lung Mass Tissue Biopsy with AFB stain, showing Acid fast bacilli present within scattered histiocytes.

To our knowledge, this is the first case report of *M. chimaera* in a healthcare worker with a long incubation period reflecting the nature of *M. chimaera* slow growth and documenting *M. chimaera* as potential etiology of disease in healthcare workers exposed to bioaerosols emitted from contaminated Heater-Cooler devices during open heart surgery.

Author statement

Christian Rosero, MD: Investigation, Writing- original draft
Wael Shams, MD: Writing- Reviewing and Editing, Supervision

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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