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SHORT REPORT
Mycobacterium avium subsp. *avium* and *Mycobacterium neoaurum* detection in an immunocompromised patient

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SUMMARY

Non-tuberculous mycobacteria are increasingly described as infectious agents in immunocompromised patients. A 17-year-old male patient suffering from secondary non-Hodgkin's lymphoma and treated with chemotherapeutic agents was admitted to hospital due to pleuropneumonia. *Mycobacterium neoaurum* was cultured repeatedly from his sputum and, *Mycobacterium avium* subsp. *avium* (*M. a. avium*) was detected by IS*901* qPCR from detached fragments of his intestinal mucosa. We attempted to determine the possible sources of infection by analysing environmental samples from the closed oncology unit and conventional unit in the hospital, and from the patient's home residence and places which he frequented. The environment of the patient harboured mycobacteria (41 isolates in total); however, *M. neoaurum* was not recovered. *M. a. avium* was detected by qPCR in the environmental samples from a small flock of hens kept by his neighbour. Although it was not confirmed by DNA fingerprinting methods, the *M. a. avium* infection could have been acquired through the eating of incompletely cooked eggs.

Key words: Foodborne infections, mycobacteria.

Mycobacterium avium subsp. *avium* (*M. a. avium*) is the causal agent of avian tuberculosis especially in domestic and wild birds [1, 2]. Infected birds shed large numbers of the organism into the environment, where it keeps its virulence and represents a source of infection for other animals and humans [1]. Although at a low incidence, *M. a. avium* usually causes pulmonary disease [3], but it can also infect the small intestine [4]. This is a frequent complication in AIDS patients, leading to intolerance to antiretroviral therapy or general worsening of the condition. *M. a. avium* infection is considered to be acquired from environmental sources, most commonly water [5]. *M. neoaurum* has rarely been found in humans, and there are only a small number of reports of *M. neoaurum* infection in immunocompromised patients. Infection has usually been associated with catheter placement or generalized mycobacteraemia; *M. neoaurum* has mostly been found in the blood of patients [6]. A case of pulmonary infection in a woman with a history of asthma has also been reported [7]. The hospital environment is thought to be a common feature of almost all of the described infections, with water identified as the source of infection in one study [8].

We describe the case of a 17-year-old male patient. The patient's primary diagnosis was Burkitt's lymphoma in the neck area, confirmed by translocation

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Table 1. *Examination of the patient's environment in the hospital and his home by mycobacterial culture*

Location	Examined	Microscopy positive	Culture positive	Isolate (*n*)
Hospital 'closed unit'				
Water	8	3	4	*M. gordonae* (1) *M. intracellulare* (1) *Mycobacterium* sp. (2)
Sediment	3	2	2	*M. gordonae* (1) *M. intracellulare* (1)
Dust	9	1	0	
Spider webs	2	0	0	
Subtotal	22	6	6	
Hospital 'conventional unit'				
Water	2	0	2	*M. gordonae* (1) *M. intracellulare* (1)
Scrapings	2	1	2	*M. gordonae* (1) *M. intracellulare* (1)
Soil	4		3	*M. gordonae* (1) *M. intracellulare* (1) *Mycobacterium* sp. (1)
Dust	2	1	0	
Subtotal	10	2	7	
Home 'inside the house'				
Potting soil	13	10	10	*M. celatum* (1) *M. intracellulare* (3) *M. a. hominissuis* (3) *M. interjectum* (1) *M. kumamotonense* (1) *Mycobacterium* sp. (1)
Dust	6	1	0	
Spider webs	6	0	1	*M. intracellulare* (1)
Water	3	0	0	
Subtotal	28	11	11	
Home 'garden'				
Parsley	1	1	1	*M. interjectum* (1)
Soil	6	4	4	*M. engbaekii* (1) *Mycobacterium* sp. (3)
Dust	4	2	1	*Mycobacterium* sp. (1)
Compost	3	1	1	*Mycobacterium* sp. (1)
Water	2	0	0	
Hay	2	0	0	
Woodshavings	3	0	0	
Subtotal	21	8	7	
Student club				
Dust	13	1	2	*Mycobacterium* sp. (2)
Spider webs	3	1	1	*Mycobacterium* sp. (1)
Plaster	2	0	0	
Subtotal	18	2	3	
Neighbour's chicken coop				
Water	2	0	0*	
Dust	3	1	0*	
Spider webs	2	0	0*	
Biofilm	1	1	1	*M. a. hominissuis* (1)
Soil	1	1	1	*M. a. hominissuis* (1)
Subtotal	9	3	7	
Total	108	32	41	

* *M. a. avium* was detected by qPCR according to Slana *et al.* [9] in amounts of 10^2–10^5 cells/g.

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t8;14 (q24,q32). He was successfully treated according to the Berlin-Frankfurt-Munich (BFM) 95 protocol for treatment of oncology patients. Four years later he developed mediastinal T-cell non-Hodgkin's lymphoma (T-NHL) as a secondary malignancy. During a period of almost 5 years of anti-cancer treatment he had been repeatedly admitted to hospital, as over 80% of the chemotherapy cycles were followed by episodes of neutropenic fever. During the late intensification phase of his second lymphoma therapy he developed febrile neutropenia with massive pleural effusion, requiring drainage. X-rays and CT examinations revealed bronchopneumonia on the left lung and bilateral sinusitis. He did not respond to standard empirical treatment with antibiotics and antifungal agents. Clinical improvement was very slow after prolonged treatment with cotrimoxazole. The cause was not established until the sputum samples were examined for the presence of mycobacteria.

During the hospitalization and anti-cancer treatment he suffered from diarrhoea and his stool bore mucosal fragments; granulomatous inflammation was diagnosed by standard histological examination. These fragments were negative for the presence of fungal pathogens.

Mycobacterial cultures of the sputum samples repeatedly yielded *M. neoaurum* isolations. The mycobacterial cultures of the fragments of intestinal mucosa were negative; however, the presence of *M. a. avium* was confirmed by IS*901* qPCR, performed according to Slana *et al*. [9].

The patient received ciprofloxacin treatment for 3 months, and his condition improved markedly. He was on continuous complete remission of his lymphomas for two more years, when he developed tertiary malignancy, acute myeloid leukaemia, to which he eventually succumbed, 7 years after initial diagnosis and 3 years after the mycobacterial infection.

Thirty-two samples from the oncology unit in the university hospital were collected in order to establish possible sources of mycobacteria. The hospital is a large, well-equipped NIAHO (National Integrated Accreditation for Healthcare Organizations) accredited tertiary referral centre where standard disinfection and maintenance regimens apply. In the 'closed unit' used for patients on chemotherapy, air circulation is controlled by differential pressures and equipped with HEPA filters. The patient was living in a rural area, without any animals in his home, although animals were kept in most of the surrounding households. From the patient's house and garden 76 environmental samples were collected (samples consisted of garden soil, roots and leaves of vegetables and herbs grown in the garden, as well as spider webs, dust, water and sediment) including nine environmental samples from the neighbour's chicken coop where a small flock of hens supplied the patient's family with eggs (Table 1). The neighbour's residence was a few metres away and the patient sometimes helped to collect the eggs. The environmental samples were examined by culture as described previously [1]. Isolates were identified by sequencing of the 16S rRNA gene according to Harmsen *et al.* [10]. Nine environmental samples originating from the flock of hens belonging to the neighbour were additionally tested by IS*901* qPCR [9]. From the environmental samples from the hospital and patient's house, 37 isolates were recovered. The species identified included *M. gordonae*, *M. intracellulare*, *M. interjectum*, *M. engbaekii*, *M. a. hominissuis*, *M. kumamotonense*, and *M. celatum*. There was no *M. neoaurum* isolate in the samples collected from the environment, and thus the source of *M. neoaurum* infection was not established. *M. a. avium* was detected by qPCR in environmental samples from the neighbour's chicken coop. Many species of environmental mycobacteria were found in the home and close surroundings of the patient.

In the case of intestinal infection with *M. a. avium*, contaminated hen eggs are the probable source of infection. Although a link between the *M. a. avium* found in the patient and that found in the hens' environment has not been proven due to the lack of isolates, repeated exposure to high amounts of the infectious agent could contribute to infection/colonization.

In the developed world, there is a steady increase in people suffering from impairments of the immune system, with increased susceptibility to mycobacterial infections. Thus, it is important to increase public awareness of the possible routes of infection with environmental mycobacteria, especially since there are now more ecological farms where the animals are at higher risk of infections. Consumption of food originating from infected animals, or from animals living in environments harbouring high numbers of mycobacteria should be considered risky for immunocompromised individuals.

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DECLARATION OF INTEREST

None.

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