Legionnaires' disease and occupational risk: a case report

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Abstract

We report results of environmental microbiological sampling in an office building whose occupants referred different symptoms ascribable to the air conditioning system. *Legionella pneumophila* serogroup 1 was detected in water samples drawn from the cooling tower with counts that ranged from 1.4 x10^5 to 1.5x10^7 CFU/L. This biological agent is classified in the second risk group according to Italian law (D.Lgs. 626/94), consequently proper control measures in order to re-establish acceptable hygienic environment conditions and to assure healthy workplace are needed.

Introduction

Cooling towers and evaporative condensers have been implicated in a number of outbreaks of Legionnaires' disease:[1-3] Transmission by aerosols has been extensively reported and evidence of *Legionella* in aerosols derived from cooling towers has been provided. When bacterial concentrations in the aerosol are low, the resulting exposure may be an asymptomatic infection which is not accompanied by any recognisable symptoms. However, when bacteria concentrations in the aerosol are high, exposure can result in Legionnaires' dis ease.[4,5] We report results of an environmental investigation performed in a six floor office building, whose occupants had reported several different symptoms ascribable to air the conditioning system. The primary objectives of this study were i) evaluating the characteristics and maintenance state of the air conditioning system; ii) carrying out environmental microbiological sampling in order to detect biological agents released in the offices from the air outlets or cooling towers associated with the air conditioning system, which might present a risk for the health of the employees; iii) classifying identified biological agents into risk groups and providing proper control measures according to Italian law (D.Lgs. 626/94).

Methods

We contacted the building's maintenance staff in order to have a look at the project design and the records for the maintenance of the air conditioning system. Subsequently, a walk-through investigation of the building and air conditioning system, including air handling units, humidifiers and two cooling towers took place. We evaluated one cooling tower (the other was not working) for biofilm growth, scale, sediment debris, biological deposits, water turbidity and location relative to the fresh-air intake of air conditioning system. A total of five samples were drawn from the cooling tower located on a terrace of the second floor of the building next to the fresh-air intake. Samples were collected in sterile glass bottles and sampling sites are showed in Table 1. The pH and temperature were measured just before the sample collection. Isolation of *Legionella* spp was performed by concentrating 1 litre of water using 0.2 µm filter membranes (Isopore filter membranes, polycarbonate GTTP) according to "Italian guidelines on prevention and control of Legionellosis".[6] Briefly, the filter membrane was suspended in 10 ml of the original sample and vortex-mixed for 10 minutes. To reduce contamination by other microorganisms, one part of the sample was pretreated by incubation in a water bath at 50°C for 30 minutes. Buffered charcoal yeast extract (BCYE) selective agar plates (Oxoid, Basingstoke, UK) were inoculated with 0,1 ml of the water samples, incubated at 36°C in a humid 2.5% CO_2 environment and examined after 4, 8 and 10 days. Suspect *Legionella* colonies were sub-cultured onto BCYE agar with cysteine and charcoal yeast extract (CYE) agar (cysteine free). Only colonies grown on BCYE were subsequently identified by an agglutination test (Legionella Latex Test, Oxoid, Basingstoke, UK), that allows a separate identification of *L. pneumophila* serogroup 1 and serogroup 2-14 and the detection of seven *Legionella* species which have been implicated in human disease.

Results

Biological growth, deposits, scale and sediment debris were detected by visual inspection of the

cooling tower. *Legionella pneumophila* serogroup 1 was detected in 5 (100%) of the samples drawn from the cooling tower. Water temperature was 34°C and pH 7.5. Viable *legionella* counts ranged from 1.4 x10^5 to 1.5x10^7 CFU per litre (Table 1).

Table 1. Sampling sites and viable counts of Legionella pneumophila serogroup 1 isolated from the cooling tower.

Sample number	Sampling site	Concentration (CFU/L)
1	Spray water	2.2 x 10^5
2	Basin water	1.4 x 10^5
3	Basin incrustations	6.3 x 10^5
4	Water and debris of the bottom of the basin	4.2 x 10^6
5	Biological deposits on the bottom of the basin	1.5 x 10^7

Discussion

The risk of occupational exposure to *Legionella* spp has been reported amongst workers employed at cooling towers, oil drilling platforms, plastics factories, sewage treatment plants and dental facilities as well as amongst gardeners, miners, turbine operators and subway personnel etc.[7] Is not easy to identify all of the occupations posing the risk of Legionnaires' disease and, without doubt, the exposure risk for workers with occupations that require them to work in sealed buildings is not very well-known or studied. All the water samples collected from cooling tower were contaminated with high concentrations of *Legionella pneumophila* serogroup 1, presenting a serious risk for office workers. When the water contaminated with bacteria was dispersed into the air as an aerosol from the tower, it could enter the building via the windows or the air intake of the air conditioning system after which occupants could then inhale it. Owing to the detection of *Legionella pneumophila*, a biological agent classified in the second risk group according to Italian law (D.Lgs. 626/94), proper control measures, aiming to re-establish acceptable environmental hygiene conditions, to ensure healthy workplaces are needed.

References

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