

Short Communication

A Case of Nosocomial *Legionella pneumophila* Pneumonia

Keizo Torii, Yoshitsugu Inuma¹, Motoshi Ichikawa², Keisuke Kato², Michio Koide³,
Hisashi Baba⁴, Ryujiro Suzuki⁵ and Michio Ohta*

Department of Bacteriology and ²Department of Internal Medicine,
Graduate School of Medicine, University of Nagoya, Nagoya 466-8550,

¹Department of Clinical Laboratory Medicine, Kyoto University Hospital, Kyoto 606-8507,

³Department of Internal Medicine I, School of Medicine Ryuky University, Okinawa 903-0215 and

⁴Department of Infectious Disease and

⁵Department of Clinical Laboratory Medicine, Nagoya University Hospital, Nagoya 466-8550, Japan

(Received April 11, 2003. Accepted May 23, 2003)

SUMMARY: We report a case of *Legionella pneumophila* pneumonia in a patient with interstitial lung disease. Intensive environmental investigations revealed that a system of all-day-running bathwater was the source of infection. In this case, the concentration of *L. pneumophila* in the hospital bathwater was low. We therefore emphasize that even a low concentration of *L. pneumophila* in environmental water can cause serious infections to immunocompromised patients in a hospital.

A 72-year-old woman was admitted to the Nagoya University Hospital for treatment of idiopathic pulmonary fibrosis. She was treated with methylprednisolone at an initial dose of 2 mg/kg a day, then reduced to 1 mg/kg when she developed current episode of pneumonia occurred. As a result of the improvement of the condition by this therapy, the patient sometimes returned home on weekends. On June 23, 2000, she again went back home, and returned to the hospital with high fever and fatigue on June 25. Although there had been no sign of infection before she left the hospital on the 23rd, chest X-ray film taken on June 26 showed intense infiltration in the right upper lung field. Laboratory findings revealed elevated C-reactive protein (53.3 mg/dL), leukocytopenia (1,900/ μ l), and hypoxemia (PaO₂, 50.1 torr on room air), indicating severe pneumonia. After collection of sputum and blood for microbiological examination, cefotiam was administered. On June 27, acute respiratory failure was worsening and the patient was transferred to the intensive care unit. Gimenez staining of sputum and bronchoalveolar lavage fluid (BALF) showed rod-shaped bacilli in neutrophils, suggesting that this pneumonia was caused by *Legionella* spp. Based on these findings, cefotiam was replaced with sparfloxacin, erythromycin, and panipenem. Antibody titers (measured by indirect fluorescent antibodies-method) against *L. pneumophila* serogroups 1 to 6, *L. micdadei*, *L. bozemanii*, and *L. dumoffii* were all negative. Urinary antigen for *L. pneumophila* serogroup 1 was also measured using two biotests, a Legionella urine antigen EIA kit (Biotest AG, Dreieich, Germany) and binax NOW Legionella (Binax, Portland, Maine, USA), both of which failed to detect antigen in the patient's urine. Despite intensive care, the patient died on the next day.

Because it is well known that *Legionella* spp. exist ubiquitously in environmental water, environmental investigations

were performed at several points on the hospital bath, the pools in the rehabilitation unit and the bathroom of the patient's home on June 28, July 4, 18-19, and 21. *L. pneumophila* serogroups 6 and 10 (7.0×10^{-1} – 1.33×10^3 cfu/100ml) were isolated from the culture of hospital bathwater taken on July 4. The *L. pneumophila* in the patient's sputum and BALF had been subtyped to serogroup 10. *L. pneumophila* was not isolated from the patient's home or any other places in the hospital. To confirm the similarity among these strains, pulsed-field gel electrophoresis (PFGE) was performed. Figure 1 shows the results of the *Sfi*I-digested PFGE pattern

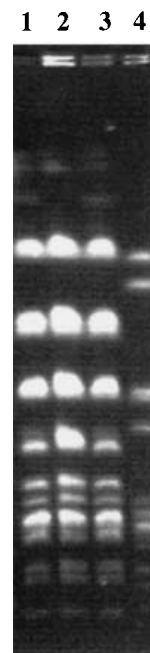


Fig. 1. *Sfi*I-digested pulsed-field gel electrophoresis pattern of *L. pneumophila* from various specimens. Lane 1: patient's sputum (serogroup 10). Lane 2: bronchoalveolar lavage fluid (serogroup 10). Lanes 3 and 4: isolates from hospital bathwater (serogroups 10 and 6, respectively).

*Corresponding author: Mailing address: Department of Bacteriology, Graduate School of Medicine, University of Nagoya, Tsurumai-cho 65, Showa-ku, Nagoya 466-8550, Japan. Tel: +81-52-744-2106, Fax: +81-52-744-2107, E-mail: mohta@med.nagoya-u.ac.jp

of these isolates. PFGE analysis revealed that *L. pneumophila* serogroup 10 from the hospital bathwater was the causative agent in this case. Given that it has been reported that the incubation time for Legionnaires' disease is generally 2 to 10 days (1), it was supposed that this patient was exposed to *L. pneumophila* in the hospital bath and infected before she went back home on June 23.

Legionnaires' disease is estimated to be present 3 to 15% of community-acquired pneumonia and 10 to 50% of nosocomial infection in European countries and the United States (2). Comparatively, the number of reported cases in Japan is much smaller (3). This gap is thought to be reflective of underdiagnosis of the disease in Japan. A striking feature of this disease in Japan is that hot springs and all-day-running hot-water baths have often been reported as the source of infection (4,5). The latter involves circulation machinery that keeps bathwater hot and allows it to be reused. The convenience of the all-day-running hot-water bath system has resulted in its prevalence in elderly-subjects care facilities as well as homes. A surprising finding, however, was recently documented by Yamamoto et al. They reported that about 36 % of water samples from all-day-running hot-water baths were contaminated with *L. pneumophila* (6). A similar finding was reported by Suzuki and colleagues (7). In the present case, the hospital used this same kind of hot-water bath system. Furthermore, the PFGE analysis revealed that the strain from the patient's sputum and the bathwater showed the same pattern. Judging from these facts, *L. pneumophila* serogroup 10 from the bathwater caused *L. pneumophila* pneumonia in this patient, although no other hospitalized patient was observed to be infected with this organism. This may be mainly because the patient was treated with corticosteroids, which made her more susceptible to *L. pneumophila* infection (8).

Another characteristic feature of this case was that *L. pneumophila* serogroup 10 was the causative organism. More than 13 serotypes of this species have already been isolated from the environment or from patients. Among these serogroups, serogroup 1 is still the most common clinical and environmental isolate (7,9). Only a few cases, including ours, have demonstrated legionellosis caused by *L. pneumophila* serogroup 10 (10,11).

In the present case, the concentration of *L. pneumophila* in the bathwater was much lower than 10 cfu/100 ml, the safety level set by the Japanese Ministry of Health, Labour and Welfare, on June 28, but was found to be 10 times higher on July 4. We therefore insist that even a low concentration of *L. pneumophila* is pathogenic to the immunocompromised patients in a hospital.

REFERENCES

1. Hoge, C. W. and Breiman, R. F. (1991): Advances in the epidemiology and control of *Legionella* infections. *Epidemiol. Rev.*, 13, 329-340.
2. Chang, F. Y. and Yu, V. L. (2001): *Legionella* infections. p. 945-949. *In* Harrison's Principles of Internal Medicine. 15th ed. McGraw-Hill, New York.
3. Tateyama, M. (2002): *Legionella*. *Jpn. J. Clin. Med.*, 60, 2166-2171 (in Japanese).
4. Mashiba, K., Hamamoto, T. and Torikai, K. (1993): A case of Legionnaires' disease due to aspiration of hot spring water and isolation of *Legionella pneumophila* from hot spring water. *J. Jpn. Assoc. Infect. Dis.*, 67, 163-166 (in Japanese).
5. Nakadate, T., Yamauchi, K. and Inoue, H. (1999): An outbreak of Legionnaire's disease associated with a Japanese spa. *J. Jpn. Respir. Soc.*, 37, 601-607 (in Japanese).
6. Yamamoto, S., Arai, T., Shirai, C., Nagura, K., Watanabe, I., Miyamoto, N., Honda, A., Nakao, C., Suzuki, M., Iba, M., Torii, K., Inoue, K. and Hattori, S. (2001): A study on contamination from *Legionella* spp. at a home for the elderly in Toyohashi City. *Jpn. J. Pub. Health*, 48, 914-922 (in Japanese).
7. Suzuki, A., Ichinose, M., Matsue, T., Amano, Y., Terayama, T., Izumiyama, S. and Endo, T. (2002): Occurrence of *Legionella* bacteria in a variety of environmental waters-from April, 1996 to November, 2000. *J. Jpn. Assoc. Infect. Dis.*, 76, 703-710 (in Japanese).
8. Carratala, J., Gudiol, F., Pallares, R., Dorca, J., Verdaguer, R., Ariza, J. and Manresa, F. (1994): Risk factors for nosocomial *Legionella pneumophila* pneumonia. *Am. J. Respir. Crit. Care Med.*, 149, 625-629.
9. Benin, A. L., Benson, R. F. and Besser, R. E. (2002): Trends in legionnaires disease, 1980-1998: declining mortality and new patterns of diagnosis. *Clin. Infect. Dis.*, 35, 1039-1046.
10. Meenhorst, P. L., Reingold, A. L., Groothuis, D. G., Gorman, G. W., Wilkinson, H. W., McKinney, R. M., Feeley, J. C., Brenner, D. J. and van Furth, R. (1985): Water-related nosocomial pneumonia caused by *Legionella pneumophila* serogroups 1 and 10. *J. Infect. Dis.*, 152, 356-364.
11. Luck, P. C., Helbig, J. H., Gunter, U., Assmann, M., Blau, R., Koch, H. and Klepp, M. (1994): Epidemiologic investigation by macrorestriction analysis and by using monoclonal antibodies of nosocomial pneumonia caused by *Legionella pneumophila* serogroup 10. *J. Clin. Microbiol.*, 32, 2692-2697.