



## Original Article

## The Chest Radiographic Manifestations of Legionnaires' Disease in Taiwan: A Retrospective Study

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### Abstract

**Objective:** To evaluate the chest radiographic manifestations of Legionnaires' disease in Taiwan.

**Materials and Methods:** From January 2003 to August 2008, we reviewed the chest X-rays of 53 patients from a medical center in east Taiwan with a diagnosis of Legionnaires' disease, confirmed by the Center for Disease Control and Prevention of Taiwan. We compared our results with those found in the current literature.

**Results:** Among the 53 patients, 44 (83%) had positive findings—shown by initial chest radiographs. Thirty patients (68%) were classified as having patchy airspace opacities, four (16%) had confluent opacities, and 11 (25%) had interstitial infiltrates. Three patients (7%) had mixed alveolar and interstitial patterns. In terms of distribution of the lesion, 23 (52%) were unilobar, 16 (36%) were multilobar and five (11%) were bilateral. The lower lobes were the most common location of involvement ( $n=32$ , 73%). Five patients (11%) had pleural effusion on presentation, but none of our patients had cavitations. Nine patients (17%) in our study had negative chest X-ray findings on initial presentation.

**Conclusion:** The radiographic manifestation of Legionnaires' disease in Taiwan is variable, ranging from normal to airspace consolidation, interstitial infiltrates, or mixed patterns. Although previously classified as atypical pneumonia, the most common radiographic findings are airspace consolidation, particularly unilobar, and located in the lower lobes. (*Tzu Chi Med J* 2009;21(3):218–221)

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## 1. Introduction

Legionnaires' disease is a febrile, pneumonic illness, which was first recognized in 1976 in Philadelphia, after a notable outbreak in a meeting of United States army veterans (1). It was responsible for 1–5% of community-acquired pneumonia requiring hospitalization (2–5). In Taiwan, the incidence of pneumonia

due to Legionnaires' disease was about 4.7% (6). The incidence rate was highest in Hualien County (5.45 per 100,000 patients) from 2001 to 2005 (7). The diagnosis of Legionnaires' disease is determined by clinical presentations, chest radiography, and bacteriological data. It is often classified as atypical pneumonia, which suggests a predominance of interstitial pattern on the chest X-rays, rather than

airspace consolidation as in the typical pyogenic pneumonias.

A study of the radiographic manifestations of Legionnaires' disease is lacking in Taiwan. The aim of this study was to evaluate the chest radiographic manifestations of Legionnaires' disease in Taiwan, and compare the results with published studies.

## 2. Materials and methods

This retrospective study was carried out in a medical center in east Taiwan from January 2003 to August 2008. Patients with a diagnosis of pneumonia or pneumonia-like disease were referred to the Center for Disease Control and Prevention of Taiwan (Taiwan's CDC). The diagnosis of Legionnaires' disease was confirmed by one of the following criteria: (1) culture isolation of *Legionella* from respiratory specimens; (2) a four-fold rise in *Legionella* antibody titer to greater than or equal to 1:128 in paired acute and convalescent serum by the use of an indirect immunofluorescent antibody test; or (3) positive *Legionella* antigen in the urine. The chest X-rays from the initial presentation of the disease were obtained and reviewed by three pulmonologists. Abnormalities were described as patchy if the airspace opacities were distributed asymmetrically within individual segments or lobes; confluent if the airspace opacities were homogeneous; or interstitial if there were diffuse reticulonodular infiltrates. The presence of pleural effusion and cavitations were also recorded. The chest X-rays were interpreted separately by each reviewer. The findings with discrepancies were reevaluated and resolved by consensus. A literature search from 1980 to present was performed on the PubMed website using the following keywords: Legionella, pneumonia, Legionnaires' disease, chest X-ray, and chest radiography. Three studies with similar diagnostic criteria and chest radiographic interpretation were reviewed and compared with our results (8–10).

## 3. Results

From January 2003 to August 2008, a total of 10,447 episodes of pneumonia were diagnosed in the hospital. Fifty-eight patients fulfilled the criteria for Legionnaires' disease by Taiwan's CDC. Among the 58 patients, 51 (88%) were community-acquired and seven (12%) were hospital-acquired. Five patients were excluded from the study because their chest X-rays were no longer available. Table 1 shows the patients' demographic distribution. Among the 53 included patients, 37 (69.8%) were male and 16 (30.2%) were female. The mean age was 65 years (range, 26–85 years). Nineteen patients (35.8%) were

**Table 1 — Demographic distribution of patients with Legionnaires' disease**

| Age (yr) | Males (n) | Females (n) | Total patients (n) |
|----------|-----------|-------------|--------------------|
| < 19     | 0         | 0           | 0                  |
| 20–29    | 1         | 1           | 2                  |
| 30–39    | 2         | 4           | 6                  |
| 40–49    | 0         | 3           | 3                  |
| 50–59    | 3         | 0           | 3                  |
| 60–69    | 9         | 2           | 11                 |
| 70–79    | 14        | 5           | 19                 |
| 80–89    | 8         | 1           | 9                  |
| Total    | 37        | 16          | 53                 |

aged between 70 and 79 years old. Fifty-one had a four-fold rise in *Legionella* antibody titer in paired serum; five had positive *Legionella* antigen in the urine and three had *Legionella* cultured from respiratory specimens. The radiographic results of our study are shown in Table 2, along with three studies from the literature review (8–10). Forty-four out of 53 patients (83%) had positive findings on the initial chest radiographs. Thirty patients (68%) were classified to have patchy airspace opacities, four (16%) had confluent opacities, and 11 (25%) had interstitial infiltrates. Three patients (7%) had mixed alveolar and interstitial patterns. In terms of distribution of the lesion, 23 (52%) were unilobar, 16 (36%) were multilobar, and five (11%) were bilateral. The lower lobes were the most common location of involvement ( $n=32$ , 73%). Upper lobe opacities were found in 15 patients (34%). Middle and lingular lobe involvement were observed in 10 patients (23%) and four patients (9%), respectively. Five patients (11%) had pleural effusion on presentation. Another three patients without pleural effusion initially developed pleural effusion 4–6 days later. None of our patients had cavitations. Nine patients (17%) in our study had negative chest X-ray findings on initial presentation—three developed patchy consolidation 5–6 days after admission.

## 4. Discussion

This is the first study in Taiwan examining the radiographic manifestation of Legionnaires' disease. In this retrospective study, the majority of patients (74%) were older than 60 years old, with most (69%) being male. The most common radiographic pattern is patchy airspace consolidation (68%), particularly unilobar (52%), and in the lower lobes (73%). Despite previously being classified as atypical pneumonia, only 25% of our patients were found to have interstitial infiltrates. This finding is consistent with the previous studies, in which airspace consolidation (either patchy or confluent) makes up of 76–96% of cases,

**Table 2 — Initial chest radiographic findings of Legionnaires' disease reported in the literature and present study\***

|                     | Tan et al (8) | Kroboth et al (9) | Godet et al (10) | Present study |
|---------------------|---------------|-------------------|------------------|---------------|
| Total patients      | 43            | 34                | 18               | 53            |
| Negative findings   | 3 (7)         | NG                | 1 (6)            | 9 (17)        |
| Positive findings   | 40 (93)       | NG                | 17 (94)          | 44 (83)       |
| Pattern             |               |                   |                  |               |
| Patchy              | 34 (78)       | 26 (76)           | 7 (41)           | 30 (68)       |
| Confluent           | 8 (18)        | NG                | 9 (53)           | 6 (14)        |
| Interstitial        | 1 (2)         | NG                | 1 (6)            | 11 (25)       |
| Mixed               | NG            | NG                | NG               | 3 (7)         |
| Distribution        |               |                   |                  |               |
| Unilobar            | 25 (60)       | 25 (75)           | 11 (65)          | 23 (52)       |
| Multilobar          | 12 (28)       | NG                | 6 (35)           | 16 (36)       |
| Bilateral           | 6 (16)        | NG                | 3 (18)           | 5 (11)        |
| Location            |               |                   |                  |               |
| Upper lobe          | 16 (37)       | NG                | 6 (35)           | 15 (34)       |
| Middle lobe         | 4 (9)         | NG                | 2 (12)           | 10 (23)       |
| Lingular lobe       | 6 (14)        | NG                | 3 (18)           | 4 (9)         |
| Lower Lobe          | 32 (74)       | 27 (79)           | 15 (88)          | 32 (73)       |
| Pleural involvement |               |                   |                  |               |
| No effusion         | 30 (70)       | NG                | 14 (82)          | 37 (84)       |
| Unilateral effusion | 8 (19)        | 12 (35)           | 1 (6)            | 5 (11)        |
| Bilateral effusion  | 2 (5)         | NG                | 2 (12)           | 2 (5)         |
| Cavitations         | 1 (2)         | NG                | 0                | 0             |

\*Data presented as n (%). NG = not given.



**Fig. 1 — Initial chest radiograph showing confluent consolidation of the right upper lobe in a 72-year-old man. Similar findings were found in another three patients.**

while the interstitial pattern is present in only 2–6% (Table 2) (8–10). This picture of airspace consolidation could be explained by a cellular immune response following *Legionella* spp. invasion, which results in acute alveolitis and exudate accumulation in the terminal respiratory unit (10). It is worth mentioning that right upper lobe involvement, either patchy or confluent, is not uncommon in our study and was found in four cases (Fig. 1). Nine patients in our study did not have active pulmonary infiltration

on the initial chest X-ray. However, follow-up chest X-ray revealed patchy consolidation in three patients 5–6 days later. Normal chest X-rays were reported as much as 6–7% in the previous study and may have represented an early phase of pneumonia (8,10). Another six patients, who presented with fever and airway symptoms, were discharged without available follow-up chest X-ray after initial workups and antibiotic treatment. Cavitation is very rare and commonly developed in immunocompromised hosts (11–13). In our study, we did not observe any patient with cavitation. None of our patients were immunocompromised or receiving corticosteroids.

In conclusion, the radiography manifestation of Legionnaires' disease in Taiwan is variable, ranging from normal to airspace consolidation, interstitial infiltrates or a mixed pattern. Although previously classified as atypical pneumonia, the most common radiographic findings are airspace consolidation, particularly unilobar in the lower lobes.

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