

Radiographic appearance of nosocomial legionnaires' disease after erythromycin treatment

Christian Domingo, Jorge Roig, Francesc Planas, Jordi Bechini, Montserrat Tenesa, Josep Morera

Abstract

Radiographic features of 71 patients (48 men, 23 women) with nosocomial *Legionella pneumophila* pneumonia were assessed and compared with those of other nosocomial series of *L pneumophila* pneumonia. Sixteen patients were assessed retrospectively and 55 prospectively. Chest radiographs were assessed at the onset of the illness, 10 days later, and at 3 months. Erythromycin was given to 67 patients at the time of the diagnosis and to the remaining four at a later stage. Forty eight patients were over the age of 60. On the initial chest radiograph 53 of the 71 patients had unilateral shadowing (23 of them in the right lung); 35 had unilobar shadowing and the remaining 36 had more than one affected lobe. Pleural effusion was present in 24 cases and cavitation in 2. One patient had evidence of a pericardial effusion. At 10 days 21 patients had evidence of radiographic progression (14 ipsilateral), but 28 had improved. At 3 months 36 patients had an abnormal radiograph, 30 showing residual scarring, 15 loss of volume, six pleural shadows and two cavitation. Our series shows a lesser incidence of unilateral shadowing and pleural effusion than other nosocomial series and a lesser tendency to progression, but more patients had radiographic abnormalities at long term follow up.

It is now 46 years since the first isolation of a *Legionella* species,¹ later identified as *L micdadei*.² Since the characterisation of the organism causing the 1976 Philadelphia epidemic of legionnaires' disease and the isolation of *L pneumophila*³ there has been considerable progress in the understanding and identification of infections due to *Legionella* species.⁴⁻⁷ Nosocomial aspects of legionnaires' disease have been assessed, including the radiographic features, which do not differ from those observed in community acquired legionnaires' disease.⁸⁻¹⁰ A few prospective studies comparing nosocomial *L pneumophila* legionnaires' disease with hospital acquired pneumonia due to other bacteria have included radiographic features,^{11,12} and radiographic features of community acquired legionnaires' disease have been compared with those of other types of pneumonia.¹³⁻¹⁵

Our purpose in this paper is to describe the

radiographs of 71 patients with nosocomial legionnaires' pneumonia in whom the standard treatment was erythromycin. Some of the patients included in this series were included in a previous report,¹² where further details about them can be found. The radiographic features in our series are compared with those reported in 55 other well documented cases of nosocomial pneumonia.^{9,16}

Methods

PATIENTS AND DIAGNOSTIC CRITERIA

From October 1983 to June 1989 74 patients developed hospital acquired legionnaires' disease in our centre. The pneumonia was considered nosocomial when it developed in hospital or during the first week after discharge, or if the patient had been paying daily visits to the hospital. The diagnosis of legionnaires' disease was accepted when one of the following criteria was present: a positive legionella culture from sputum, bronchial aspirate, bronchoalveolar lavage fluid, or lung tissue; or a fourfold rise in antibody titre (indirect fluorescent antibody test) or a single titre equal to or greater than 1/256 in the acute phase of the disease. When a direct fluorescent antibody test on tracheobronchial secretions gave a positive result another diagnostic criterion was required for the patient to be included in the series.

RADIOGRAPHS

Sixteen patients were assessed retrospectively and 55 prospectively. The initial radiograph (the one closest to the onset of symptoms), an immediate follow up radiograph (performed 8-10 days later), and a long term follow up radiograph (two to three months after the onset) were assessed. A radiograph taken on the eighth, ninth, or tenth day of illness was available for 58 patients (the omissions being due to death or lack of a radiograph taken at this time for some of the retrospective cases). A long term follow up radiograph was available for only 37 patients, as many patients who lived a long way from the hospital failed to return for this assessment.

The radiographs were reviewed independently and classified by three of the authors—two experienced radiologists and a pneumologist specialising in infectious lung disease. The affected lobe was usually identified by posteroanterior and lateral views. Among the 55 patients assessed prospectively, most of those who appeared to have a pleural

**Servei de
Pneumologia**
C Domingo
J Roig
F Planas
J Morera

Servei de Radiologia
J Bechini
M Tenesa

**Hospital Germans
Trias i Pujol,
Barcelona, 08916,
Spain**

Reprint requests to:
Dr Domingo

Accepted 11 June 1991

Table 1 Radiographic features of nosocomial legionnaires' disease

	No of cases
AT PRESENTATION (n = 71)	
Extent of shadowing	
Unilateral	53
Right lung	24
Left lung	29
Bilateral	18
One lobe	35
More than one lobe	36
Pleural effusion	24
Cavitation	2
AFTER 8-10 DAYS (n = 58)	
Progression	17
In the same lung	11
To the opposite lung	6
Persistence	18
Improvement	23
Pleural effusion	15
Cavitation	6
AT LONG TERM FOLLOW UP (n = 37)	
Normal radiograph	18
Abnormal radiograph	19
Residual scarring	16
Loss of volume	8
Pleural shadows	3
Cavitation	1

effusion on the chest radiograph had a thoracentesis to confirm it. In the remainder a lateral decubitus film was usually attempted if there was doubt about the presence of effusion or if the clinician considered that the patient, for whatever reason, was not suitable for thoracentesis. Computed tomography was not performed routinely. Neither radiologist was aware of the clinical outcome.

TREATMENT

Sixty seven patients were given erythromycin at the time of diagnosis and the other four at some time during the disease. Three patients who received other antibiotics are not included in this series. The dose of erythromycin was 4 g/day initially, administered intravenously. When the patient had been afebrile for at least three days the same dose was given orally to complete a three week course of treatment.

Table 2 Pre-existing risk factors in 71 cases of nosocomial acquired legionnaires' disease

	No of patients
Previous pulmonary disease	30
Current smoking	31
Previous heart disease	17
Chronic liver disease	12
Alcoholism	12
Surgery	12
Malignant neoplasm	10
Chronic renal failure	9
Kidney transplant	3
Haemodialysis	6
Diabetes mellitus	6
Immunosuppressive treatment (including corticosteroids)	18
Previous antibiotic treatment	16
Previous H ₂ antagonist treatment	12
Nebuliser use	10
Gastroscopy or nasogastric aspiration	8
Assisted ventilation	3
Morbid obesity	2

Table 3 Comparison of radiographic features in the present series of patients with nosocomial legionnaires' disease and two previous series

	No (%) of patients	
	Present study	Helms et al ⁹ Kirby et al ¹⁶
Unilateral shadowing*	53/71 (75)	46/50 (92)
Initial pleural effusion*	24/71 (34)	22/35 (62)
Immediate progression**	17/58 (29)	45/55 (82)
Long term normality*	18/37 (48)	19/21 (90)†

*p < 0.01; **p < 0.001 (Fisher's exact test).

†These 21 patients are only those reported by Kirby¹⁶ as Helms's series did not include a long term assessment.

ANALYSIS

Patients were divided according to the number of risk factors present into those with only one risk factor and those with two or more risk factors. Fisher's exact test was used to compare the incidence of unilateral or bilateral shadowing in patients with one and with two or more risk factors, the percentage of patients with initial bilateral shadowing who had one or two or more risk factors, and the incidence of radiographic features in our study compared with the findings in 55 previously reported cases.

Results

Seventy one patients were assessed (48 men, 23 women). Fifty one patients were more than 60 years old, the other 23 being 20-60. All but one of the species of *Legionella* in these 71 cases were eventually identified as *L pneumophila*; in one case the exact species was not definitively established.

The findings on the initial, the 10th day, and the long term follow up chest radiographs are shown in table 1. The anatomical distribution of the affected lobes on the initial radiograph showed a predominance of lower lobe disease (lower lobe 51, upper lobe 24, and lingula or middle lobe 19 cases). Twenty of the 24 pleural effusions seen on the initial radiograph were confirmed by pleural aspiration. One patient showed the radiographic appearance of a pericardial effusion and this was confirmed by echocardiography. It was still present on the 10 day radiograph but eventually disappeared.

The risk factors we considered, and their incidence in this series, are specified in table 2. Of the 71 patients, 47 (66%) had two or more risk factors. Of the 47 patients with two or more risk factors, the shadowing on the initial chest radiograph was bilateral in 16 (34%) and unilateral in 31 (66%) (p = 0.001). Of the 18 patients with bilateral shadowing on the initial chest radiograph, 88% had at least two risk factors and only 12% one risk factor (p < 0.001).

Discussion

The purpose of our study was to provide a detailed description of the radiographic features of a large series of adults with legionnaires' disease. Four relevant aspects require

emphasis: the study was restricted to cases of legionellosis acquired in hospital; most patients were assessed prospectively; specific diagnostic criteria were required for a patient to be included in the series; and erythromycin was given to all patients. The incidences of some radiographic features in the present study with those reported in two previous well documented series are compared in table 3.

Our series shows a clear predominance of unilateral shadowing at the initial presentation. This has been a feature of all series of both nosocomial and community acquired legionnaires' disease.⁸⁻¹⁷ Our incidence of 75% initial unilateral shadowing is lower than that reported in previous studies of nosocomial infection (table 3),^{9,16} perhaps because our patients had more risk factors.

Almost half of the patients had shadowing in one lobe only. The incidence of lower lobe shadowing (72%) is similar to that reported in other series of nosocomial infection.^{8,9,12} The reported incidence of upper lobe shadowing has ranged from 26%⁹ to 65%,¹⁶ our figure of 34% falling between these values.

The presenting chest radiograph was thought to show a pleural effusion in 34% of our patients, a significantly lower figure than that reported by Kirby.¹⁶ The reported frequency of pleural effusion has varied widely.¹⁸

An interesting feature of our series is the low incidence of extension of shadowing between the initial and the immediate follow up radiograph. It has been said that the initial radiograph usually shows a unilateral infiltrate that extends as the disease progresses over several days to more widespread shadowing.¹⁵ Only 29% of our patients showed such progression, a lower incidence than that reported in other series of nosocomial legionnaires' disease.^{9,16} Prompt treatment with erythromycin in our patients is most likely to be responsible for this low incidence of radiographic progression.

Despite treatment with erythromycin, almost 10% of our patients had cavitory lesions at 10 days. Cavitation has been reported only rarely and not at all in some large series of legionnaires' disease.^{16,18-20} It has been suggested that cavitation occurs more commonly in patients with severe underlying immunosuppression.^{4,5,8,9,12,15} Three of our patients had recently received a kidney transplant and the others were having high doses of corticosteroids.

Pericardial effusion is undoubtedly a rare manifestation of legionnaires' disease, only seven cases having been reported so far,²¹⁻²⁶ five with associated lung manifestations and two without. Our case is the first asymptomatic pericardial effusion presenting at the same time as pulmonary manifestations.

Legionella organisms were found in hilar lymph nodes in 44% of cases in one necropsy series²⁷ and this may cause the hilar adenopathy found in a few patients in the series of Helms *et al.*⁹ None of our patients showed this radiographic feature.

Of the 37 patients available for evaluation at long term follow up, only 18 (48%) had a

completely normal radiograph. This percentage is slightly lower than that given by Macfarlane *et al* in 42 cases of community acquired legionnaires' disease,¹³ where 29% had residual linear opacities and 7% a pleural shadow. Our results are strikingly different from those of Kirby *et al*¹⁶ (table 3), despite the fact that patients in both series were treated with erythromycin. By examining pulmonary specimens obtained from surgery or immediately after death, Chastre *et al*²⁸ found interstitial pulmonary fibrosis in five of 12 patients with legionnaires' disease caused by *L pneumophila* despite prompt treatment. We saw no cases of widespread pulmonary fibrosis, though 18 of our patients were critically ill and required admission to the intensive care unit. The data of Chastre *et al* should be interpreted with caution because of the small number of cases and the fact that most of the five cases with fibrosis were diagnosed on the basis of histological samples obtained at necropsy.

- 1 Tatlock H. A rickettsia-like organism isolated from guinea pigs. *Proc Soc Exp Biol Med* 1944;57:95-9.
- 2 Herbert GA, Moss CW, McDougal LD, Bozeman FM, McKinney RM, Brenner DJ. The rickettsia-like organisms TATLOCK (1943) and HEBA (1959): bacteria phenotypically similar to but genetically distinct from *Legionella pneumophila* and the WIGA bacterium. *Ann Intern Med* 1980;92:45-52.
- 3 McDade JE, Shepard CC, Fraser DW, Tsai R, Redus MA, Dowdle WR. Legionnaires' disease: isolation of a bacterium. *N Engl J Med* 1977;297:1197-203.
- 4 Bartlett CLR, Macrae AD, Macfarlane JT. *Legionella infections*. 1st ed. London: Arnold, 1986:1-163.
- 5 Davis GS, Winn WC Jr. Legionnaires' disease: respiratory infections caused by legionella bacteria. *Clin Chest Med* 1987;8:419-39.
- 6 Finegold SM. Legionnaires' disease: still with us. *N Engl J Med* 1988;318:571-3.
- 7 Fang GD, Yu VL, Vickers RM. Disease due to the Legionellaceae (other than *Legionella pneumophila*). Historical, microbiological, clinical, and epidemiological review. *Medicine* 1989;68:116-32.
- 8 Kirby BA, Snyder KM, Meyer RD, Finegold SM. Legionnaires' disease: report of sixty-five nosocomially acquired cases and review of the literature. *Medicine* 1980;59:188-205.
- 9 Helms CM, Viner JP, Weisenburger DD, Chiu LC, Renner ED, Johnson W. Sporadic legionnaires' disease: clinical observations on 87 nosocomial and community-acquired cases. *Am J Med Sci* 1984;288:2-12.
- 10 Korvick JC, Yu VL. Legionnaires' disease: an emerging surgical problem. *Ann Thorac Surg* 1987;43:341-7.
- 11 Yu VL, Kroboth FJ, Shonnard J, Brown A, McDearman S, Magnussen M. Legionnaires' disease: new clinical perspective from a prospective pneumonia study. *Am J Med* 1982;73:357-61.
- 12 Roig J, Aguilar X, Ruiz J, Domingo Ch, Mesalles E, Manterola J, *et al.* Comparative study of *Legionella pneumophila* and other nosocomial-acquired pneumonias. *Chest* 1991;99:344-50.
- 13 Macfarlane JT, Miller AC, Roderick Smith WH, Morris AH, Rose DH. Comparative radiographic features of community acquired legionnaires' disease, pneumococcal pneumonia, mycoplasma pneumonia, and psittacosis. *Thorax* 1984;39:28-33.
- 14 Granados A, Podzaczek D, Gudiol F, Manresa F. Pneumonia due to *Legionella pneumophila* and pneumococcal pneumonia: similarities and differences on presentation. *Eur Respir J* 1989;2:130-4.
- 15 Muder RR, Yu VL, Parry MF. The radiologic manifestations of Legionella pneumonia. *Semin Respir Infect* 1987;2:242-54.
- 16 Kirby BD, Peck H, Meyer RD. Radiographic features of legionnaires' disease. *Chest* 1979;76:562-5.
- 17 Fairbank JT, Mamourian AC, Dietrich PA, Girod JC. The chest radiograph in legionnaires' disease. *Radiology* 1983;147:33-4.
- 18 Broome CV. Pneumonia due to *Legionella* species. *Semin Infect Dis* 1983;5:16-35.
- 19 Dietrich PA, Johnson RD, Fairbank JT, Walker JS. The chest radiograph in legionnaires' disease. *Radiology* 1978;127:577-82.

- 20 Tsai TF, Finn DR, Plikaytis BD, *et al.* Legionnaires' disease: clinical features of the epidemic in Philadelphia. *Ann Intern Med* 1979;**90**:509-17.
- 21 Harris LF. Legionnaires' disease associated with massive pericardial effusion [letter]. *Arch Intern Med* 1981;**141**:1385.
- 22 Landes BW, Pogson GW, Beauchamp GD, Skillman RK, Brewer JH. Pericarditis in a patient with legionnaires' disease. *Arch Intern Med* 1982;**142**:1234-5.
- 23 Maycock R, Skale B, Kohler RB. *Legionella pneumophila* pericarditis proved by culture of pericardial fluid. *Am J Med* 1983;**75**:534-6.
- 24 Friedland L, Snyderman DR, Weingarden AS, Hedges TR, Brown R, Busky M. Ocular and pericardial involvement in legionnaires' disease. *Am J Med* 1984;**77**:1105-7.
- 25 Nelson DP, Rensimer ER, Burke CM, Raffin TA. Cardiac legionellosis. *Chest* 1984;**86**:807-8.
- 26 Domingo C, Roig J, Seres J. Pericardial effusion as a clinical sign of legionnaires' disease. *Intern J Cardiol* 1989;**23**:407-9.
- 27 Weisenburger DD, Helms CM, Renner ED. Sporadic legionnaires' disease. A pathologic study of 23 fatal cases. *Arch Pathol Lab Med* 1981;**105**:130-7.
- 28 Chastre J, Raghu G, Soler P, Brun P, Basset F, Gibert C. Pulmonary fibrosis following pneumonia due to acute legionnaires' disease. Clinical, ultrastructural, and immunofluorescent study. *Chest* 1987;**91**:57-62.