

Legionella pneumophila Serogroup 1 Strain Paris: Endemic Distribution throughout France

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An analysis of 691 French clinical *Legionella* isolates showed that the endemic *L. pneumophila* serogroup 1 strain Paris was responsible for 12.2% of all cases of legionellosis and had a specific pulsed-field gel electrophoresis pattern. We also demonstrated the presence of this endemic clone throughout Europe.

Legionella pneumophila is a common cause of hospital- and community-acquired pneumonia. About 90% cases of legionellosis are due to this species, and the predominant serogroup (sg) 1 of *L. pneumophila* accounts for 84% of cases (15). *Legionella* is present in naturally occurring and man-made water systems and is transmitted to humans by aerosol inhalation (2). The source of infection can be identified by comparing environmental and clinical *L. pneumophila* isolates with a variety of typing methods. Pulsed-field gel electrophoresis (PFGE) is one of the most widely used typing methods and is generally considered to be highly discriminatory (5, 10–12, 14). PFGE can identify unique strains of *L. pneumophila* with a specific PFGE profile; these strains are considered sporadic. Most reported cases of legionellosis in Europe are sporadic, as shown by the European Working Group on *Legionella* Infections (EWGLI) data set (http://www.ewgli.org/data/data_yeardatatable.asp). Confirmed epidemic cases of legionellosis are defined as at least two cases arising from the same source and due to the same strain. The recovery of PGFE-identical isolates over long periods in given countries or continents suggests that some *L. pneumophila* clones are endemic (13).

The presence of an endemic *L. pneumophila* sg 1 clone was suspected in 1997 when Lawrence et al. (9) reported that 33% of the cases of legionellosis identified in the Paris area between 1988 and 1997 were caused by a single *L. pneumophila* sg 1 strain. The cases had no apparent epidemiological links and were both hospital and community acquired. The same strain has since been repeatedly recovered throughout the Paris water distribution network. The distribution in France of this strain, designated *L. pneumophila* sg 1 strain Paris (CIP 107-629-T), is not known.

The French National Reference Center for *Legionella* (NRCL) collects all French clinical *Legionella* isolates and types them by conventional PFGE method by using the *Sfi*I

enzyme (9). We reviewed here the epidemiological data on 691 clinical *Legionella* strains isolated in 118 different towns in France between January 1998 and December 2002.

Legionella pneumophila constituted 98.6% of the 691 isolates (Table 1). *L. pneumophila* sg 1 was the predominant serogroup (90.0%), and sg 2 to 15 accounted for the remaining serogroups (10.0%). The most commonly isolated non-*pneumophila* species were *L. longbeachae* (four cases), *L. anisa* (four cases), and *L. dumoffii* and *L. gormanii* (one case each). This epidemiology is consistent with previous reports (8, 15).

A total of 559 different PFGE patterns were obtained with the 691 isolates. Most patterns ($n = 543$) were unique and corresponded to a single *Legionella* isolate; these were sporadic cases with no identified epidemiological link. Of the 691 isolates, 148 were associated with outbreaks or were linked to

TABLE 1. Identification of species and subgroups of 691 clinical *Legionella* isolates received by the NRCL between January 1998 and December 2002

<i>Legionella</i> sp. and serogroup	No. of isolates	%
<i>L. pneumophila</i>	681	98.6
1	613	88.7
2	5	0.7
3	19	2.75
4	1	0.14
5	6	0.87
6	11	1.6
7	1	0.14
9	1	0.14
12	1	0.14
14	1	0.14
Unknown	22	3.2
<i>L. longbeachae</i>	4	0.6
<i>L. anisa</i>	4	0.6
<i>L. dumoffii</i>	1	0.14
<i>L. gormanii</i>	1	0.14
Total	691	100

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TABLE 2. Incidence and geographical distribution of *L. pneumophila* serogroup 1 strain Paris in France between 1998 and December 2002

Yr	Total <i>Legionella</i> clinical strains (n)	Paris strain			Town(s) of clinical isolation
		n (%)	Cases infected:		
			In the Paris area (n)	Outside the Paris area (n)	
1998	126	11 (8.7)	11	0	Paris
1999	106	8 (7.5)	7	1	Paris, Nice
2000	135	29 (21.5)	21	8	Paris, Antibes, Frejus, Lyon, Marseille, Nice, Poitiers
2001	160	17 (10.6)	6	11	Paris, Colmar, Grenoble, Limoges, Lyon, Marseille, Nice, Strasbourg
2002	164	19 (11.6)	9	10	Paris, Annecy, Bordeaux, Compiègne, Frejus, Forbach, Lyon, Marseille, Nice, Reims
Total	691	84 (12.2)	54	30	

the Paris strain (84 isolates). Each of the 16 outbreaks was caused by a strain with a specific PFGE pattern and involved two to nine patients. We showed that the endemic Paris strain predominates in France, accounting for 12.2% (Table 2) of cases of legionellosis. This clone was associated with both hospital-acquired (52.4%) and community-acquired (40.5%) infections and caused both outbreaks and sporadic cases. It was mainly isolated in Paris (64.3%) but was also found in at least 15 other French towns located up to 900 km from Paris. The

PFGE pattern of all of the Paris strains did not differ, even by a single band, in all French isolates, regardless of the site or time of isolation (Fig. 1).

We also studied 79 unrelated *L. pneumophila* sg 1 clinical isolates from the European collection of *L. pneumophila* sg 1, provided by EWGLI, to detect the presence of strain Paris outside France (5). We demonstrated that the PFGE profile of the Paris strain was similar to that of strains EUL 1 and 3 (Switzerland); EUL 37, 38, and 43 (Italy); EUL 53 and 55

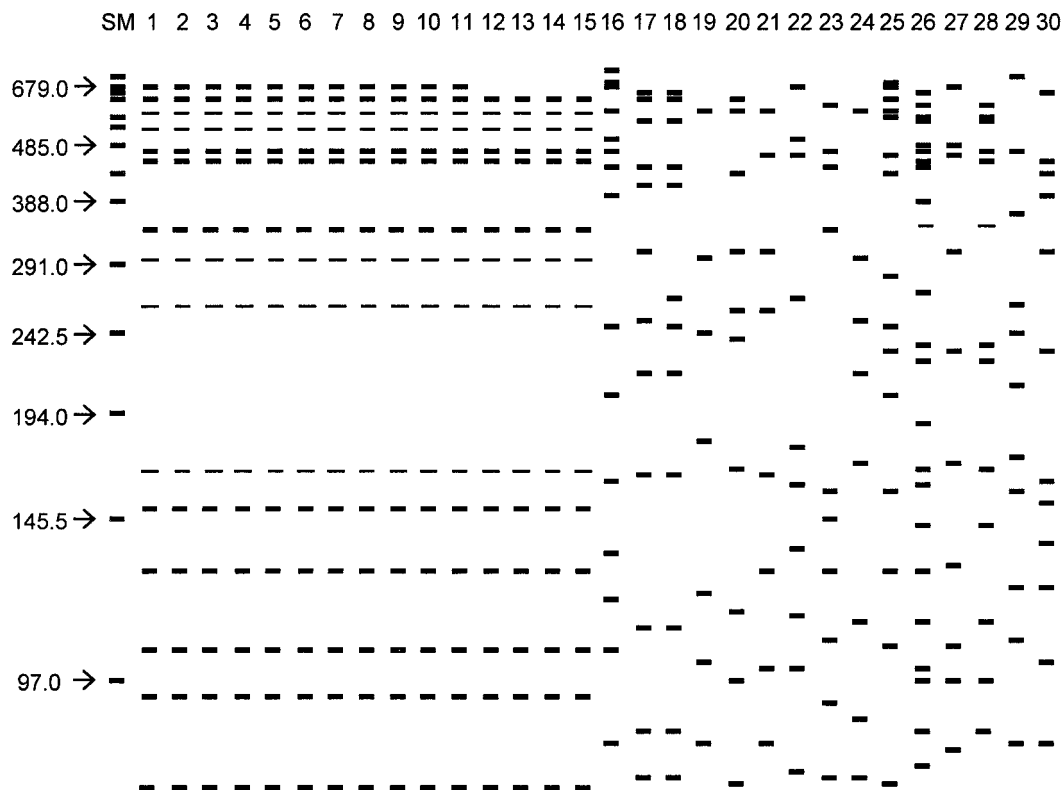


FIG. 1. Schematic representation of PFGE profiles (using *Sfi*I restriction enzyme) of the following clinical *L. pneumophila* strains: Paris strain isolated in different towns in France (lanes 1 to 11), strain EUL 1 Switzerland (lane 12), strain EUL 55 Spain (lane 13), strain EUL 104 Sweden (lane 14), strain EUL 37 Italy (lane 15), French epidemic strains (lanes 16 to 19), and French sporadic strains (lanes 20 to 30). Size markers (SM) are given in kilobases.

(Spain); and EUL 104 (Sweden). Figure 1 shows the pulso-types of four of these strains; all of the European strains had the same profile, which was identical to the Paris strain except that it lacked a 680-kb fragment. This points to a widespread European distribution of an *L. pneumophila* sg 1 endemic clone. Endemic clones of *L. pneumophila* causing apparently unrelated cases of legionellosis have been identified by several authors (3, 4, 7, 10, 11, 13). For instance, Selander et al. observed endemic *Legionella* clones with a wide geographical distribution in a study of the genetic structure of *L. pneumophila* populations by multilocus enzyme electrophoresis (13).

The clinical predominance of this strain could be due to its greater abundance in water distribution systems, to its higher virulence, or to its greater facility to be recovered from clinical specimens, although we have no evidence to support either of these hypotheses. Indeed, the PFGE type distribution of environmental *L. pneumophila* sg 1 strains is not as well characterized in France as that of clinical strains (environmental isolates are not systematically typed by PFGE). The multiplication rate, which could reflect the virulence of the Paris clone for human cells (1, 6), is unknown. However, Lawrence et al. showed that patients infected by the Paris strain did not differ significantly from patients infected by other strains in terms of age, sex, risk factors, need for mechanical ventilation, or mortality (9).

The Paris strain is known to colonize the entire water distribution network in the Paris area since 1987 (9), suggesting that this clone is well adapted to environmental survival. A review of NRCL data show that isolates with the Paris profile have also been isolated from the water distribution systems of at least 10 of the French towns in which clinical strains have been isolated. Other researchers have suggested that widespread geographical diffusion of *Legionella* strains may occur through rain and wind transportation (13). The apparent spread of the Paris strain in France and Europe might simply reflect improved surveillance and recent routine application of molecular typing methods rather than being a recent phenomenon. The characteristics of the Paris strain appear to be very stable, since PFGE profiles remained stable among all French strains isolated between 1987 and 2002. The strict identity of all Paris isolates remains to be confirmed by multilocus sequence typing, a method based on DNA sequences that would allow us to compare the genetic background of the Paris strain to other clinical *Legionella* strains.

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