

and only reluctantly admitted to a recurrence of symptoms at outpatient follow up.

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## Human listeriosis and paté: a possible association

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### Abstract

**Objectives**—To study trends in human listeriosis and determine possible sources of infection.

**Design**—Descriptive analysis of laboratory reports of human listeriosis together with a survey of subtypes of *Listeria monocytogenes* isolated from patients and foodstuffs and an interview survey of patients to obtain food histories.

**Setting**—United Kingdom and Republic of Ireland 1985 to 1990.

**Results**—There was a near doubling in the incidence of human listeriosis in England, Wales, and Northern Ireland between 1985 and mid-1989 followed by a sharp decline. The upsurge in cases was caused largely by two strains of *L monocytogenes*, which accounted for 30-54% of the annual totals. These strains were less common before 1987 and after July 1989. A survey of paté in England and Wales in July 1989 showed that it frequently contained *L monocytogenes*. A similar survey in July 1990 showed a reduction in the proportions of samples contaminated. In 1989 patés from a single plant (manufacturer Y) were more likely to be contaminated by *L monocytogenes* and at higher levels than those from other producers. Most strains of *L monocytogenes* recovered from manufacturer Y's paté in 1989 were indistinguishable from those responsible for the 1987-9 upsurge in human listeriosis and were uncommon among isolates from patés from other manufacturers and from a wide range of other foodstuffs. Patients infected with the types of *L monocytogenes* found in paté were significantly more likely to have recently eaten paté than those affected by other strains. The start of the decline in numbers of cases of listeriosis coincided with government health warnings on paté consumption and the suspension of supplies from manufacturer Y.

**Conclusions**—Contamination of paté was a likely contributory cause of the increase in the incidence of listeriosis between 1987 and 1989.

### Introduction

Listeriosis has caused considerable public health concern in recent years following a series of cases of foodborne infection and an increase in incidence in most industrialised countries, including the United Kingdom.<sup>1</sup> In May 1989, during the routine investigation by the Public Health Laboratory Service of a case of suspected food poisoning, paté taken from a patient's refrigerator was found to contain high levels of *Listeria monocytogenes*. This chance finding led to a local survey in south Wales during May and June 1989<sup>2</sup> and a government health warning to vulnerable groups on paté consumption.<sup>3</sup> The results of the Welsh survey prompted a nationwide investigation by the PHLS to test the hypothesis that there was an association between human listeriosis and the consumption of contaminated paté.

### Methods

**Epidemiology**—Surveillance of human listeriosis has been undertaken by the PHLS since the 1960s. The Communicable Disease Surveillance Centre receives reports of cases in England, Wales, and Northern Ireland through the national voluntary laboratory reporting scheme. Isolates of *L monocytogenes* for confirmation of identity and subtyping are collected in the division of microbiological reagents and quality control from the United Kingdom and the Republic of Ireland. After mid-1988 patients identified by the surveillance scheme were interviewed by their doctor (or by a microbiologist or public health physician with the doctor's agreement) using a standard questionnaire to obtain a food history covering the three weeks before onset of the illness. Information specifically on the consumption of paté was sought after mid-1989.

**Subtyping of *L monocytogenes***—*L monocytogenes* isolated from infected patients and a wide variety of foodstuffs (>1300 samples) were subtyped in the division of microbiological reagents and quality control using serotyping,<sup>4,5</sup> phage typing,<sup>4</sup> and DNA restriction fragment length analysis.<sup>6</sup>

**Surveys of paté on sale in 1989 and 1990**—In July 1989, 53 PHLS laboratories examined 1698 samples of paté (25 g) on sale to the public in England and Wales for the presence of *L monocytogenes*. A similar survey was performed in July 1990, when 16 laboratories examined 626 samples. These surveys will be reported in more detail elsewhere.

### Results

#### TRENDS IN HUMAN LISTERIOSIS

Fewer than 100 cases of listeriosis were reported annually in England, Wales, and Northern Ireland between 1967 and 1982.<sup>7</sup> Numbers of cases then increased, at first slowly, to 115 in both 1983 and 1984, 149 in 1985,<sup>7</sup> and 137 in 1986. A near doubling of cases then occurred to 259 in 1987, 291 in 1988, and 250 in 1989. Subsequently only 90 cases were reported up to the end of September 1990 compared with 228 in the same period in 1989.

Analysis of the seasonal pattern of listeriosis has shown a consistent increase in cases in the late summer to early autumn.<sup>8</sup> Similar seasonal peaks occurred in 1986 and 1987, and there were also winter peaks in 1985 and 1987. In 1988, however, the winter and autumn peaks were absent. In 1989 the fall in the annual totals was caused by a sharp decline which occurred after a July peak (figure). In the first nine months of 1990 a seasonal pattern was absent (figure).

Changes also occurred in the distribution of clinical types of listeriosis. These changes were most pronounced in the proportions of infections during pregnancy and in neonates, which accounted for 38% of the total between 1983 and 1987, 42% in 1988, 52% in 1989, but only 22% in the first nine months of 1990.

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SUBTYPING OF *L. MONOCYTOGENES* FROM CASES

The annual distribution of selected subtypes of *L. monocytogenes* from cases in England, Wales, Scotland, Northern Ireland, and the Republic of Ireland (1985-90) is shown in table I. Between 1987 and 1989, 30-54% of the annual totals were due to a restricted range of subtypes (serotype 4b phage type 6,7 and serotype 4bX), which had occurred less commonly both before and after this period.

Between 1987 and 1989 isolates from 567 (69%) of all 823 cases were serotype 4b, and 279 of these (34%) were of a single phage type, designated 6,7 (table I). Phage type 6,7 was less common in 1985-6 and 1990, accounting for less than 9% of all cases during both these periods.

We reported the emergence of infection with *L. monocytogenes* serotype 4bX in 1987, when 23 (9%) of 248 cases were due to this type<sup>5</sup> (only two cases due to this type had been identified during 1985-6). In 1988 and 1989 serotype 4bX accounted for 27 (9%) of 309 cases and 49 (18%) of 266 cases respectively. Restriction fragment length polymorphism analysis showed that 4bX isolates from 50 of 51 cases occurring during 1988-9 formed a homogeneous group (probe type cc,i,ee,dd) and differed from all serotype 4bX isolates from 22 cases in 1987.

During 1989 the proportions of cases due to serotype 4b phage type 6,7 and serotype 4bX changed with the season: 46 of 77 cases (60%) occurred in the first quarter of the year, 56 of 85 (66%) in the second, 42 of 83 (51%) in the third, and two of 21 (10%) in the last quarter. In the first nine months of 1990 isolates from 92 cases were received: none were serotype 4bX and only eight (9%) were serotype 4b phage type 6,7 (table I).

SURVEYS OF PATÉ ON SALE IN 1989 AND 1990

The surveys of paté on sale in July 1989 and July 1990 not only confirmed the presence of *L. monocytogenes* in paté sold nationwide but also showed a decline in the presence and levels of the organism between the two periods (table II). During the 1989 survey, however, samples of paté from a single plant (manufacturer Y) were more likely to be contaminated by *L. monocytogenes* and at higher levels than those of other producers. Of 107 samples of patés from manufacturer Y, 51 (48%) were contaminated by *L. monocytogenes*, and in 12 of 50 of these (over 11% of all samples from manufacturer Y) contamination was at levels of  $\geq 1000/g$ . By contrast, of 781 patés from other identifiable producers, 33 (4%) were contaminated, five of 29 (over 0.6% of all the samples) at levels

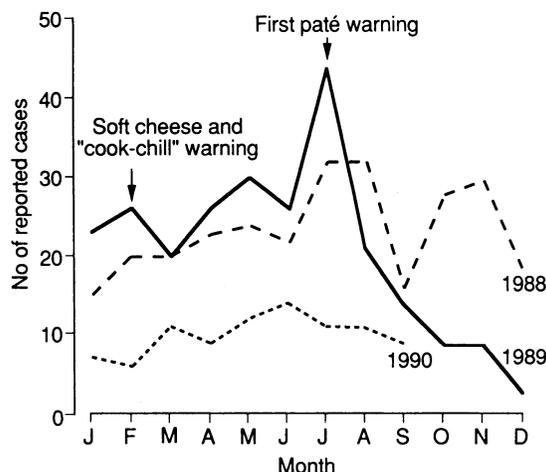
TABLE I—Annual distribution of selected subtypes of *L. monocytogenes* from cases of human listeriosis in England, Wales, Scotland, Northern Ireland, and Republic of Ireland 1985-90. Figures are numbers of cases

Subtype	1985	1986	1987	1988	1989	1990*
4bX	2	0	23	27	49	0
4b phage type 6,7	1	5	72	110	97	8
4b other phage types	60	58	103	84	73	41
4b not phage typed	29	3	6	22	0	0
1/2	46	36	41	65	46	42
Other	4	6	3	1	1	1
Total	142	108	248	309	266	92

\*January to September only.

TABLE II—PHLS surveys of *L. monocytogenes* in paté on sale in England and Wales in July 1989 and July 1990

	July 1989	July 1990
Total No of samples examined	1698	626
No (%) with <i>L. monocytogenes</i> detected	162 (9.5)	25 (4.0)
No (%) with level $\geq 1000/g$	33 (1.9)	2 (0.3)



Monthly totals of cases of human listeriosis in England, Wales, and Northern Ireland 1988-90. (Stated warnings refer to government advice to vulnerable groups to avoid eating soft cheese and paté and to reheat cook-chill meals until piping hot)

of  $\geq 1000/g$ . The manufacturers of the remaining 810 samples could not be identified.

*L. monocytogenes* serotype 4b phage type 6,7 and 4bX strains accounted for 96% (48/50) of all isolates from manufacturer Y's paté compared with 19% (6/31) of those from other producers in the 1989 survey, 4% (1/25) in the 1990 survey, and were rare in other foods (table III). The higher rate of recovery of *L. monocytogenes* serotype 4b phage type 6,7 in patés from other producers in the 1989 survey (table III) compared with the 1990 survey and with other foodstuffs may have been due to cross contamination among patés at the retailer. Eleven of the samples from manufacturer Y and 10 from other manufacturers were sold from displays of open dishes, where utensils were commonly shared.

Restriction fragment length polymorphism analysis of *L. monocytogenes* serotype 4bX from nine paté samples (eight from manufacturer Y) showed that all were probe type cc,i,ee,dd. Four out of seven serotype 4bX isolates from other foodstuffs collected between 1987 and 1989 were of this probe type.

No samples of paté eaten by patients with listeriosis were available for examination.

PATIENT INTERVIEWS

There was significant association between recent paté consumption and infection with the subtypes of *L. monocytogenes* found in paté. Thirteen of 15 patients whose illness was caused by *L. monocytogenes* serotype 4b phage type 6,7 or 4bX had eaten paté within three weeks before onset compared with six of 17 patients whose strains were not of the types found in paté ( $p=0.0095$  ( $\chi^2$  test with Yates's correction)).

Discussion

In England, Wales, and Northern Ireland between 1986 and 1987 there was a sharp increase in the annual totals of reported cases of human listeriosis, and after 1987 the annual autumn peak which had been recorded over the previous 10 years<sup>8</sup> was absent (figure). The increase in reported cases continued until mid-1989, after which there was a sharp decline (figure). In 1990 the numbers of cases continued at a much lower level and resembled the totals reported before 1987. Similar trends were observed in Scotland<sup>9</sup> (D M Campbell, personal communication). Between 1987 and 1989 much of the upsurge in human listeriosis was due to two subtypes of *L. monocytogenes* (serotype 4b phage type 6,7 and serotype 4bX probe type cc,i,ee,dd), which accounted for 30-54% of the annual totals of cases. These two strains were much less common both

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TABLE III—Subtypes of *L. monocytogenes* from foodstuffs in Britain. (Percentages in parentheses)

Subtype	Pâté			
	1989 Survey		1990 Survey	Other foodstuffs 1987-9
	Manufacturer Y	Other identifiable producers		
1/2	3 (6.0)	23 (71.9)	21 (84.0)	733 (62.5)
4b†	37 (74.0)	7 (21.9)	1 (4.0)	339 (28.9)
4bX	11 (22.0)	1 (3.1)	0	11 (0.9)
Other	0	1 (3.1)	3 (12.0)	89 (7.6)
Total	50* (100.0)	32 (100.0)	25 (100.0)	1172 (100.0)
4b phage type 6,7/total 4b phage typed†	37/37	5/6	1/1	4/186

\*One sample contained *L. monocytogenes* serotype 1/2 and 4b.

†Excluding serotype 4bX.

before 1987 and after mid-1989 (table I). Trends in the annual totals, the alteration of the seasonal pattern, and the distribution of subtypes of *L. monocytogenes* all suggested a change in the epidemiology of listeriosis between 1987 and 1989 and were consistent with the occurrence of one or a small number of common source outbreaks. We had previously reported similar clusters of cases of listeriosis in Britain due to single strains of *L. monocytogenes* but vehicles of infection were not identified.<sup>5 10</sup>

Surveys in Britain (table III) and in other countries<sup>11</sup> have generally shown that when *L. monocytogenes* has been recovered from food serogroup 1/2 is the most common. Hence it was unusual to find pâtés to be so frequently contaminated with *L. monocytogenes* serotype 4b, especially those from manufacturer Y. These pâtés were also unusual in their frequent contamination with strains rarely isolated from food—that is, serotype 4b phage type 6,7 and serotype 4bX probe type cc,i,ee,dd (table III).

In February 1989 the government warned of the dangers to vulnerable groups of listeriosis from soft cheese and of the need to reheat cook-chilled foods and ready to eat poultry until piping hot.<sup>12</sup> This first warning may have contributed to the reduction in the numbers of cases of listeriosis except those due to *L. monocytogenes* serotype 4b phage type 6,7 and serotype 4bX (table I). Further government health warnings in July and August 1989 (figure) on the consumption of pâté<sup>13</sup> coincided with the suspension from sale of pâté from manufacturer Y and was followed by a sharp decline in the overall numbers of cases, particularly those due to serotype 4b phage type 6,7 and serotype 4bX. Samples of pâté from this single manufacturer were more commonly contaminated with *L. monocytogenes* and at greater levels than those from other producers tested in 1989. Most of the *L. monocytogenes* isolated from manufacturer Y's pâté were indistinguishable from the very restricted range of strains largely responsible for the 1987 to mid-1989

upsurge in human listeriosis. Patients infected with the strains of *L. monocytogenes* found in pâté were also significantly more likely to have recently eaten pâté than those affected by other strains. These findings provide circumstantial evidence for a link between some recent cases of listeriosis in Britain and the consumption of pâté. No direct microbiological evidence linking cases with the consumption of this foodstuff was obtained as samples of pâté were not available from any of the patients.

Although the microbiological quality of foods may have improved since 1989 and contributed to the decline in the numbers of cases (as suggested for pâté), our evidence reinforces the advice from the Department of Health that pregnant women and immunocompromised patients should avoid eating pâté.<sup>3 13</sup> Indeed, the change in the proportions of clinical types of listeriosis in 1990 may reflect a change in eating habits, particularly of pregnant women, as a result of this advice and the extensive coverage by the media. Vulnerable people should also heed the advice from the chief medical officer to avoid eating soft cheese and to reheat cook-chill meals and ready to eat poultry until piping hot.<sup>12</sup>

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## ANY QUESTIONS

*What treatment is advised for a woman of 70 with a supraspinatus tear with impingement associated with degeneration of the supraspinatus tendon? What is the prognosis?*

You must first ask how the diagnosis was made. A complete rupture of the supraspinatus tendon is more difficult and unpredictable than a partial tear or tendinitis, which is far more common. Pain with subsequent inability to actively abduct the shoulder may be of neuromuscular origin (neuralgic amyotrophy); reduction or loss of active and passive range may arise from a supraspinatus tendinitis or capsulitis of the shoulder without a supraspinatus tear; impingement of the greater tuberosity under the acromion may occur in modest osteoarthritis of the shoulder.

If the supraspinatus tendon is ruptured surgical repair is not usually advised or effective in this age group. Active physiotherapy may improve the range of movement and function by the use of trick movements. In the event of severe painful disability due to a partial tear or tendinitis local corticosteroid injections and active physiotherapy should restore comfort and movement. If the pain arises mainly from impingement of the greater tuberosity under the acromion excision of the acromion will relieve pain.

The prognosis for a complete rupture of the supraspinatus tendon in this age group is poor, whereas the prognosis for partial tears or tendinitis is one of slow improvement of comfort and function. Accurate and precise diagnosis is often difficult, and improved methods of imaging and direct visual examination by arthroscopy are increasingly being used. —COLIN G BARNES, consultant physician, London