

Special Features of Distribution of *Yersinia pseudotuberculosis* in Japan

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The incidence of *Yersinia pseudotuberculosis* isolation from humans, animals, water, and pork in Japan is presented on the basis of a review of the literature and serotyping of 633 strains referred to our laboratory. Most of the strains belonged to serogroup 4b, followed in frequency of isolation by serogroups 3, 1b, 5b, 5a, and the others, whereas serogroup 1a has not been detected. Although strains were isolated from 11 species of animals, none were isolated from birds.

In a previous report (5), we described the isolation and serogroups of *Yersinia pseudotuberculosis* in Japan during the period from 1913, when it was first reported by Saisawa (1), until 1969. Furthermore, we pointed out that it was isolated less frequently in Japan than in European countries. Since 1970, many reports have been made on human infection with *Y. pseudotuberculosis* and surveys of this organism

group, with a peak at 1- to 2-year-old children. Outbreaks of infection by this organism in Japan have occurred (Table 1). For instance, Izumi fever, a childhood illness of previously unknown etiology, is caused by *Y. pseudotuberculosis* (2, 3). The clinical symptoms of *Y. pseudotuberculosis* infections are various. Common clinical symptoms are fever, abdominal pain, diarrhea, nausea, and vomiting. Strawberry tongue,

TABLE 1. Outbreaks of *Y. pseudotuberculosis* infection in Japan

Outbreak	Location	Suspicious materials	No. of patients	Diagnosed by:	Serogroup
April 1977 ^a	Middle school	Unknown	57	Antibody	5b
October 1977 ^a	Kindergarten	Water (?)	82	Antibody	1b
February 1981 ^a	Elementary school	Vegetable juice	188	Isolation	5a
February 1981	Urban	Sandwiches	11	Isolation	5b
December 1982	Mountain area	Water	140	Isolation	4b
July 1984 ^b	Middle school	Barbecue	35	Isolation	5a
July 1984 ^b	Family	Barbecue	4	Isolation	5a
November 1984	Elementary school and kindergarten	Unknown	63	Isolation	3
November 1984	Mountain area	Water	11	Isolation	4b
April 1985	Elementary school and kindergarten	Unknown	8	Isolation	4b
April 1985	Elementary school	Unknown	60	Isolation	4b
March 1986	Elementary school	School lunch	549	Isolation	4b

^a Diagnosed as Izumi fever.

^b Same restaurant.

from animals and environmental sources.

This report presents information on the incidence of human infection from and isolation of some specimens in Japan.

Human infection. Since 1970, infection due to *Y. pseudotuberculosis* has been increasing, and there are many reports on sporadic infection (6) and outbreaks (4). Sporadic infection appears to be concentrated in the 1- to 16-year age

desquamation of digits, and myalgia are occasionally found. Secondary immunological complications, such as erythema nodosum, arthritis, and renal insufficiency, have also been observed. These symptoms closely resemble those of Kawasaki syndrome (mucocutaneous lymph node syndrome), an important illness of children in Japan.

Nonhuman infections. *Y. pseudotuberculosis* has been isolated from 11 species of animals. Of those, monkeys, goats, rabbits, and guinea pigs were diseased, whereas cattle, swine, dogs, raccoon dogs, cats, hares, house rats, and wild rats were carriers. No isolates of the organism were obtained from birds in Japan. *Y. pseudotuberculosis* is

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TABLE 2. Sources and serogroups of *Y. pseudotuberculosis*

Source	No. of isolates of serogroup:											UT ^a	
	1b	2			3	4		5		6	7		8
		a	b	c		a	b	a	b				
Human	30	11	18	6	9	4	114	26	54				
Cattle			1										
Monkey	16						4						
Swine	28		7	10	107		40	2	1				
Goat	1												
Dog	12		2	1	1	2	17	5		1	1		
Raccoon dog				1									
Cat	2		1	1	4		11						
Rabbit	3		1		1		2		9				
Hare				1									
Guinea pig	2				2			3		3			
Rat	1					7					1	1	
Pork							1						
Water		2	2	2			12	5	16	2			3

^a UT, Untypeable.

TABLE 3. Characteristics of distribution and serogroups of *Y. pseudotuberculosis* and some features of pseudotuberculosis in Japan

Area	Host ^a			Serogroup ^a						Characteristics of human infection				
	Swine	Hare	Bird	1a	2c	4b	5b	6	7	8	Age (yr)	Sex (male:female)	Age group susceptible to septicemia	Frequency of infection
Japan	+++	+	-	-	+	+++	+++	+	+	+	1-3	1.5:1	Infant or child	Often
Europe	++	+++	+++	+++	-	-	-	-	-	-	8-15	3:1	Adult	Rare

^a +++, Many isolates; ++, some isolates; +, a few isolates; -, no isolates.

observed to have low incidence in hares, although it is reported to have a high incidence of isolation from this animal in European countries.

Pork. The rate of isolation from meat is not high, and only one strain of the organism (serogroup 4b) was isolated from pork.

Drinking water. *Y. pseudotuberculosis* was isolated from drinking water at a considerably high rate, as drinking water comprises nonchlorinated well water and mountain stream water.

Distribution of serogroups. The majority of strains of human origin belonged to serogroup 4b, which was followed in frequency of isolation by serogroups 5b, 1b, 5a, 2b, and the others. The strains of nonhuman origin were predominantly serogroup 3, followed by serogroups 4b, 1b, 5b, 2c, and the others. Serogroups 6, 7, and 8 were isolated from animals and water and not from humans. Serogroup 1a was not isolated from human or nonhuman sources (Table 2). Of the 107 strains of serogroup 3 isolated from swine, 76 strains were melibiose nonfermenters.

Special features of distribution of *Y. pseudotuberculosis* in Japan. Some special features of human infection by *Y.*

pseudotuberculosis and epidemiological problems in Japan are summarized in Table 3.

LITERATURE CITED

1. Saisawa, K. 1913. Über die Pseudotuberkulose beim Menschen. Z. Hyg. Infektionskr. 73:353-400.
2. Sato, K. 1987. *Yersinia pseudotuberculosis* infection in children. Contrib. Microbiol. Immunol. 9:111-116.
3. Sato, K., K. Ouchi, and M. Takai. 1983. *Yersinia pseudotuberculosis* infection in children, resembling Izumi fever and Kawasaki syndrome. Pediatr. Infect. Dis. 2:123-126.
4. Tsubokura, M., and M. Maruyama. 1988. Epidemiology of *Yersinia pseudotuberculosis* infection, p. 105-120. In H. Izawa and Y. Shumizu (ed.), Progress in veterinary science. Kindai Shuppan, Tokyo. (In Japanese.)
5. Tsubokura, M., K. Itagaki, and K. Kawamura. 1970. Studies on *Yersinia (Pasteurella) pseudotuberculosis*. I. Sources and serological classification of the organism isolated in Japan. Jpn. J. Vet. Sci. 32:227-233.
6. Tsubokura, M., K. Otsuki, M. Sato, K. Ouchi, M. Tanaka, T. Hongo, H. Fukushima, and M. Inoue. 1987. Distribution of *Yersinia pseudotuberculosis* in Japan and epidemiology of human infection. Jpn. J. Assoc. Infect. Dis. 61:737-745. (In Japanese with an English summary.)