

Original Article

Intrafamilial transmission of *Salmonella oranienburg*

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Abstract

Background: There were diffuse outbreaks of *Salmonella oranienburg* in Japan since March 1999 which included 1505 patients. The outbreak was caused through ingestion of a dried squid snack contaminated with *S. oranienburg*. Such a large number of cases has not been previously recorded in Japan or other countries.

Methods: A 9-month-old boy was admitted to our hospital with enteritis and bacteremia due to *S. oranienburg*. His older brother had eaten the contaminated snack. We detected *S. oranienburg* in the stools of five out of his six family members.

Results: With the exception of the index case's brother, no other family members had eaten the contaminated snack. The *S. oranienburg* strain detected in the family was confirmed to be the same strain by pulse field gel electrophoresis. Therefore, we presumed there had been a series of household transmissions.

Conclusion: Our observation of intrafamilial transmission suggests that *S. oranienburg* may be highly infectious.

Key words

food poisoning, household infection, *Salmonella oranienburg*.

Thirteen cases of enteritis due to *Salmonella oranienburg* were first reported in Kawasaki City in March 1999.¹ The causative food was a snack made of dried squid by the same manufacturers. Thereafter, within a period of approximately 2 months, 1505 patients from all over Japan were confirmed to have this condition by the Japanese government.² Such a spread of infection and such a large number of cases had not been previously recorded in Japan or other countries. Many other clinical manifestations, such as sepsis, suppurative arthritis, osteomyelitis and abdominal abscess were reported in these cases. We here report a case in which *S. oranienburg* appeared to be highly infectious.

Case report

The index case, an infant boy aged 9 months who had been in good health, developed watery diarrhea on 30 April, 1999. His diarrhea gradually became exacerbated and his temperature

rose to 39°C on 10 May. He was admitted to Kawasaki Medical School Hospital the next day. On examination, his temperature was 38.8°C. His abdomen was slightly distended and bowel sounds were increased.

The laboratory data on admission were as follows: white blood cell count 7800/ μ L with 15% band form, 34% segmented neutrophils and 41% lymphocytes; C-reactive protein 0.9 mg/dL; erythrocyte sedimentation rate 30 mm/hr; and positive cultures for *S. oranienburg* in his venous blood and stool. Intravenous fosfomycin was administered as the treatment. His diarrhea gradually subsided and he was discharged on 28 May, 1999.

We confirmed that the index case's older brother, a 3-year-old boy, had developed diarrhea and a low-grade fever after eating a dried squid snack in late March 1999. He was taken to see a doctor, but a stool culture was not performed. After oral administration of antidiarrheal medicines, his symptoms gradually subsided. When the index case was admitted to our hospital, he did not have any symptoms but *S. oranienburg* was detected in his stool.

His mother had developed diarrhea without eating the dried squid snack in late April 1999 and had had occasional diarrhea thereafter. His father and grandmother had not eaten the dried squid snack and had no clinical manifestations. *Salmonella oranienburg* was detected in both parents' stools on admission of the index case, but was not detected in the grandmother's stool at that time (Fig. 1). The bacterium was

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found in her normal stool during the index case's hospitalization. *Salmonella oranienburg* bacteria detected from the family were confirmed to be of the same strain using pulse field gel electrophoresis.

Discussion

In this prevalence, the experience with the dried snack suggests that *S. oranienburg* is resistant to dry conditions, because of the widespread infection due to the dried snack. The occurrence of bacteremia or septicemia with *S. oranienburg* in 32 out of 78 cases (41%) has been reported in Japanese published documents.^{3–16} The reported frequency of bacteremia in general *Salmonella* infections has been 5–10%.¹⁷ The high frequency may be characteristic of this type of *Salmonella* and/or may be associated with children who predominantly ate this snack. There is an increased risk of bacteremia in young infants, patients with underlying diseases or patients treated with antibiotics before.

We presumed that there was a series of putative household transmissions of *S. oranienburg*. The socioeconomic status of this family was middle class and the house hygiene was thought to be within usual circumstances. None of the family members had underlying diseases or had received antibiotics

before. The brother's infection was not confirmed at the time, but he appears to have been the carrier of this bacterium, because it was detected from his stool when the index case was admitted to our hospital. None of the family members except for the older brother ate the snack. We presumed that the mother might have been infected by her son, because she usually took care of his diapers. His father might have been infected by his son or his wife. The index case might have been infected by his mother or his older brother, because the mother cooked his meals and the older brother usually played with him. The grandmother took care of the older brother after admission of the index case and then her stool culture became positive. Therefore, she might have been infected through the older brother's diapers. The grandfather, who did not take care of his grandsons, was not infected during the clinical course.

The other possible transmission might have been other contaminated food. The mother might have prepared the meal after she took care of the older brother and then *S. oranienburg* could have contaminated their meal. However, there seems little possibility of this, since the grandfather was not infected by *S. oranienburg* although he had eaten the same meal every day as the rest of the family.

As 10^7 – 10^8 of non-typhoidal *Salmonella* is usually required for transmission from person-to-person,¹⁸ horizontal

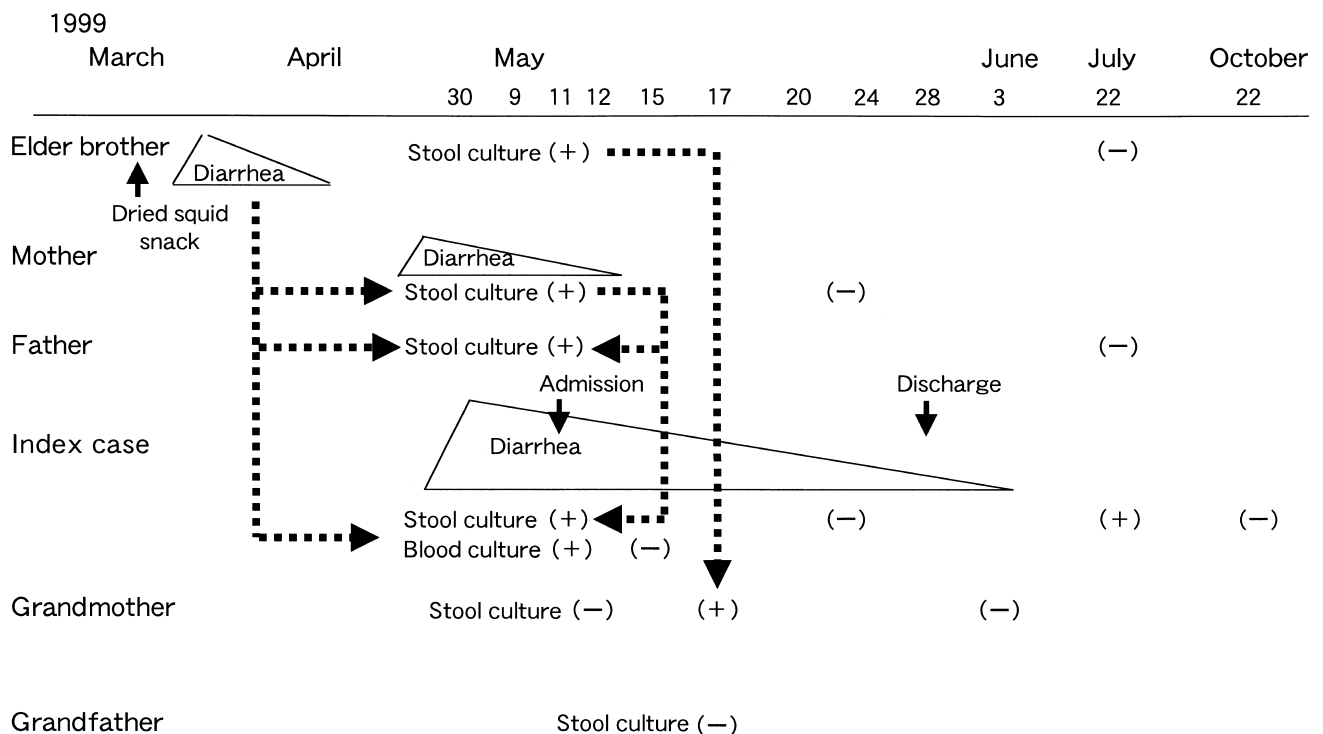


Fig. 1 The clinical course of symptoms and stool cultures in this family. The arrows with a dotted line indicate putative intrafamilial transmission of *Salmonella oranienburg*.

transmission in usual settings does not appear to be likely. The obliteration of normal bacterial flora and suppressed immunity will allow a smaller number of *Salmonella* to cause a disease.¹⁷ The other risk factors of *Salmonella* infection are individuals that are infants, the aged and patients with complicated diseases. Antibiotic therapy in acute *Salmonella* gastroenteritis prolongs rather than shortens the duration of postconvalescent excretion.¹⁹ There have been only a few reports of horizontal transmission in families.^{20,21} Many of the family members described here are thought to have been infected by person-to-person transmission because they had not eaten the contaminated snack and the strain was the same. There have been some Japanese reports suggesting intrafamilial transmission in such a prevalence.²² These findings suggest that a smaller amount of *S. oranienburg* than 10^7 – 10^8 may result in infection. Based on the Japanese experience, we believe that *S. oranienburg* is resistant to dry conditions and that it is highly infectious.

References

- Ogawa M, Sano T, Tonoka H *et al.* A diffused outbreak of *Salmonella oranienburg* food poisoning due to semidried squid snacks – Kawasaki & Hiroshima Cities. *Infect. Agents Surveill. Rep.* 1999; **20**: 112–13 (in Japanese).
- Anonymous. Salmonellosis in Japan as of June 2000. *Infect. Agents Surveill. Rep.* 2000; **21**: 162–3 (in Japanese).
- Tanaka K, Kimoto Y, Ushijima T, Furuse A. Three severe cases of *Salmonella oranienburg* infection due to dried squid 'Kansouikagashi'. *Infect. Immun. Child.* 2000; **12**: 103–6 (in Japanese).
- Mizuta S, Unemoto J, Nakagawa N, Tokunaga Y, Goto S, Kunitomi T. Clinical studies on an outbreak of food poisoning caused by *Salmonella oranienburg* and *Salmonella chester* in processed squid product. *Infect. Immun. Child.* 2000; **12**: 195–202 (in Japanese).
- Tachibana Y, Nakamura H, Sakata H, Maruyama S. A twin case of pneumoniae and sepsis due to *Salmonella* after measles infection. *Infect. Immun. Child.* 2000; **12**: 454–5 (in Japanese).
- Ohashi A, Imanishi H, Hirayama K *et al.* A case of suppurative arthritis of hip joint due to *Salmonella* infection. *Infect. Immun. Child.* 2000; **12**: 456 (in Japanese).
- Kuchiwa M, Yamaguchi K. A case of abscess in the orbit of the eye due to *Salmonella oranienburg*. *Infect. Immun. Child.* 2000; **12**: 456 (in Japanese).
- Sasaki H, Takeda S, Kanazawa H *et al.* An outbreak due to *Salmonella oranienburg* with various symptoms. *Infect. Immun. Child.* 2000; **12**: 456–7 (in Japanese).
- Goto M, Aoyama A, Kumada T *et al.* A case of acute pyelitis due to *Salmonella oranienburg*. *Infect. Immun. Child.* 2000; **12**: 457 (in Japanese).
- Uraoka M, Hasui M, Kunihi T. Three cases of *Salmonella* infection without gastroenteric symptom. *Infect. Immun. Child.* 2000; **12**: 457 (in Japanese).
- Oshima H, Terashima S, Inomata H. A clinical and bacterial investigation of *Salmonella oranienburg* infection. *Infect. Immun. Child.* 2000; **12**: 457–8 (in Japanese).
- Tsuruta S, Terashima K, Kimura M, Yoshida T, Amano M, Ueda K. Two cases of osteomyelitis and two cases of bacteremia with *Salmonella* infection due to taking dried squid snack. *Infect. Immun. Child.* 2000; **12**: 458 (in Japanese).
- Watanabe H, Hachiya M, Kohara A *et al.* Eight cases of *Salmonella* infection due to dried squid snack. *Infect. Immun. Child.* 2000; **12**: 458–9 (in Japanese).
- Miyakawa T, Sakai M, Kajiwaru Y, Shirahata S. Three cases of *Salmonella* infection due to dried squid snack. *The 26th Annual Meeting of the Japanese Society for Pediatric Gastroenterology and Nutrition*; 1999 Sept 11–12; Kurashiki, Japan (in Japanese).
- Nishida M, Fukuoka T, Yamaguchi T. A clinical investigation on fourteen cases of *Salmonella* infection in a specific area. *J. Jpn. Pediatr. Soc.* 1999; **103**: 1147–8 (in Japanese).
- Akiba T, Arai T, Ohta T, Akiba K, Sakamoto M, Yazaki N. A clinical feature of *Salmonella oranienburg* infections caused by polluted dried squid products. *Jpn. J. Pediatr.* 1999; **52**: 2091–4 (in Japanese).
- Cherubin CE, Neu HC, Imperato PJ, Harvey RP, Bellen N. Septicemia with non-typhoid *Salmonella*. *Medicine* 1974; **53**: 365–76.
- Amito E, Kasagi T. Recent problems of salmonellosis in children – Report of 9 cases and review of the literature. *J. Pediatr. Prac.* 1977; **40**: 1251–6 (in Japanese).
- Aserkoff B, Bennett JV. Effect of antibiotic therapy in acute salmonellosis on the fecal excretion of *Salmonellae*. *N. Engl. J. Med.* 1969; **281**: 636–40.
- Rosenstein BJ. Salmonellosis in infants and children. *J. Pediatr.* 1967; **70**: 1–7.
- Wilson R, Feldman RA, Davis J, LaVenture M. Salmonellosis in infants: The importance of intrafamilial transmission. *Pediatrics* 1982; **69**: 436–8.
- Oshima H. *Salmonella oranienburg* infection due to dried squid snack. *Med. Trib.* 2000; **33**: 36 (in Japanese).