A Case of Canine Salmonellosis due to *Salmonella* Infantis

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(Received 7 April 1998/Accepted 15 September 1998)

ABSTRACT. A 7-year-old male dog kept outdoors manifested severe watery diarrhea with generalized weakness. *Salmonella* Infantis was isolated from a fecal sample and the dog recovered soon after medication with ampicillin, to which the isolate was highly sensitive. The present case was diagnosed as *S.* Infantis infection. Due to the importance of *Salmonella* in public health, soil samples were collected from the garden where the dog was kept and were examined for *Salmonella*. Some of them were positive for *S.* Infantis, however, no *Salmonella* was isolated from any soil samples collected after thorough disinfection of the surrounded environment.—KEY WORDS: canine, public health, *Salmonella* Infantis.

J. Vet. Med. Sci. 61(1): 71–72, 1999

The incidence of *Salmonella* infection including a carrier state in dogs is very important to public health, because dogs are usually reared in contact with humans [5, 6, 9]. In foreign countries, there have been some reports on transmission of *Salmonella* from dogs to humans [2, 7]. In Japan, there have been many reports on isolation of *Salmonella* from apparently healthy dogs [3, 4, 8, 12, 13], however, so far as we know, there have been no reports on clinical features of *Salmonella* infection in dogs. The authors have previously reported *Salmonella* infections in bengalees (a variety of *Lonchura striata*) and zebra finches (*Poephila guttata*), which are very popular cage birds, for the first time in these species [10, 11]. The present paper deals with a case of *Salmonella* Infantis infection of a household dog manifesting severe diarrhea.

The dog was a 7-year-old male mongrel, 15 kg of weight, and kept outdoors in Nagano Prefecture. The dog was kept in a steel kennel set up on a roofed concrete floor, 6 m in length and 2.5 m in width, between the house and a flower bed in the garden. The dog was hold in leash, 2 m length, and allowed to move freely on the concrete floor. His owner took him out for exercise everyday. The dog is fed on a commercial dog food, and a fresh raw egg was also given twice a week. The owner gave sometimes leavings of meals to the dog, but never gave meat nor raw fish. Two years ago, the dog suffered from canine parvovirus infection exhibiting severe bloody diarrhea and was admitted to a veterinary clinic for 10 days. Since then, a combined vaccine against canine parvovirus, canine distemper virus, canine parainflenza virus and canine adenovirus was given every year to the dog at the veterinary clinic.

The dog showed such clinical symptoms as severe watery diarrhea, anorexia and generalized weakness from the end of July, 1997. Although the owner gave commercial antidiarrheic and probiotic from the 2nd day of illness for 4 days, no improvement was observed. Then, at the beginning of August, the owner submitted a fecal sample to our veterinary diagnostic laboratory in Ueda Livestock Hygiene Service Center for diagnosis.

The fecal sample was cultured overnight at 37°C on a DHL agar (Nissui, Tokyo) plate, to which novobiocin (Sigma Chemical Co., U.S.A.) was supplemented to inhibit growth of *Proteus* spp. The sample was cultured also in Hajana tetrathionate broth (Nissui, Tokyo) for enriching Salmonellae, then subculture from the broth was made on a DHL agar plate. The fecal samples cultured both directly on the DHL agar plate and in the enrichment broth gave *Salmonella*-suspected colonies and these isolates were identified as *S.* Infantis.

Four isolates were examined for antibiotic sensitivity with 14 kinds of disks of ampicillin, cloxacillin, pivmecillinam, streptomycin, kanamycin, fradiomycin, gentamicin, chloramphenicol, oxytetracycline, erythromycin, cefazolin, cefuroxime, (Showa, Tokyo), enrofloxacin (Bayer AG, Leverkusen) and oxolinic acid (Tanabe, Tokyo) on a sensitivity test agar (Nissui, Tokyo) plate. They were highly sensitive to ampicillin, pivmecillinam, cefazolin and oxolinic acid, and resistant to cloxacillin, kanamycin, fradiomycin, oxytetracycline and erythromycin according to the manufacturer's criteria (Table 1).

Table 1. Antibiotic sensitivity of *S.* Infantis isolated from the fecal sample

Antibiotics	*S.* Infantis			
	1	2	3	4
Ampicillin	+++	+++	+++	+++
Cloxacillin	–	–	–	–
Pivmecillinam	+++	+++	+++	+++
Streptomycin	+	+	+	+
Kanamycin	–	–	–	–
Fradiomycin	–	–	–	–
Gentamicin	+	+	+	+
Chloramphenicol	++	++	++	+++
Oxytetracycline	–	–	–	–
Erythromycin	–	–	–	–
Cefazolin	+++	+++	+++	+++
Cefuroxime	++	+++	++	++
Enrofloxacin	++	++	+	++
Oxolinic acid	+++	+++	+++	+++

–: resistant, +: slightly sensitive, ++: moderately sensitive, +++: highly sensitive.

The fecal sample was examined also parasitologically and neither parasitic ova nor coccidia oocysts were detected from the specimen.

The results mentioned above indicate that the dog was infected with *S*. Infantis infection. Soon after the diagnosis, the owner gave orally 200 mg of ampicillin to the dog three times a day for 5 days according to our prescription. Then, the dog recovered within 3 days after the medication. Control measures such as cleaning and disinfection of the environment were done repeatedly. A disinfectant solution containing benzalkonium chloride or sodium hypochlorite was sprayed on the concrete floor and the kennel, and slaked lime was spread on the flower bed in the garden where diarrheal feces were excreted during the incidence.

Further bacteriological surveys were carried out on the food, feces and soil samples to prevent reinfection and becoming carrier state of the dog. EEM broth (Eiken, Tokyo) enrichment was done prior to Hajana tetrathionate broth culture for the specimens. No *Salmonella* was isolated from the commercial dog food given everyday to the dog. Before control measures were taken, five soil samples were collected from the flower bed in the garden where the soil was severely contaminated with diarrheal feces. *S*. Infantis was isolated from two of these, however, *Salmonella* was not isolated from any soil samples collected 2 weeks, 1 month and 6 months after control measures were taken. Fecal samples were collected also from the dog at the same time, and they were negative for *Salmonella*.

There have been many reports concerning *Salmonella* carriers in apparently healthy dogs in Japan and the prevalence varied from 7.6 to 46.3% [3, 4, 8, 13]. In the present study, the infected dog manifested severe diarrhea with other general symptoms. *S*. Infantis was isolated from the fecal sample and the dog recovered soon after medication with ampicillin, to which the isolates were highly sensitive. According to the clinical history of the dog, possibility of canine parvovirus infection was negligible. These findings indicate that the dog in the present case suffered from *S*. Infantis infection.

As raw eggs were given to the dog in the present case, one of the possible sources of infection seemed to be eggs contaminated with *S*. Infantis. However, *S*. Infantis has not been isolated from the layer farm where the eggs derived from according to our *Salmonella* surveillance with layer farms since 1994.

Another possible source of infection seemed to be environmental contamination caused by carrier dogs during their exercise walk. Muramatsu *et al*. [8] examined 497 dogs in Nagano Prefecture where the present incidence occurred and found that 38 dogs were positive for *Salmonella*, of which *S*. Infantis was the most common serotype. Moreover, Itoh *et al*. [4] examined 574 dogs in Tokyo and isolated *Salmonella* most frequently in September followed by August, indicating a higher prevalence of the pathogen during hot season. The present dog case occurred in midsummer, and *S*. Infantis was regarded as the causative agent. It has also been reported that the infectivity of *Salmonella* harbored in canine feces was quite high [14].

Since the dog can be a very important source of human *Salmonella* infection [5, 6, 9], strict control measures should be taken when the animal is confirmed to be infected with the pathogen. In the present case, control measures such as cleaning and disinfection of the surrounded environment must have been done successfully because the dog was kept mainly on the concrete floor. However, *Salmonella* can survive for several months or longer in the intestines [13] and in the environment [1], repeated examinations are also required.

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