

Occurrence of Cross-Infection of *Salmonella* sp. (1) Serovar Typhimurium in Detained Dogs

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(Received 13 March 1991/Accepted 22 May 1991)

J. Vet. Med. Sci. 53(5): 929-930, 1991

KEY WORDS: cross-infection, detained dog, *S. Typhimurium*.

It is well known that apparently healthy dogs, including household and stray dogs, harbor salmonellae [2, 8]. In Japan, most of the past investigations about *Salmonella* carrier dogs [1, 4, 5, 9, 11] were carried out on detained dogs, and very high carrier rates were reported. Some investigators suggested that the isolation rate in detained dogs might be influenced by cross-infection with *Salmonella* occurred in dog detention premises [5, 10]. There are some studies suggesting the occurrence of cross-infection with *Salmonella* among pigs in abattoir [3, 7]. In this paper, the authors studied the possible occurrence of the cross-infection of dogs during detention.

Between June to August in 1984, feces were collected 8 times from the room kept a group of stray or unwanted dogs either on 2nd or 5th days post detention at Yokohama City Dog Center. A total of 123 samples on the 2nd day and 94 on the 5th day were cultured for *Salmonella*.

Five grams of each fecal specimen was suspended into 50 ml of Hajna tetrathionate broth (Eiken). The broth was incubated at 37°C for 24 hours. After enrichment culture, a loopful of the broth was streaked on DHL agar plate (Eiken) and MLCB agar plate (Nissui). The plate was incubated at 37°C for 24 hours. Five suspicious colonies for *Salmonella* about each plate, were sent for biochemical and serological examinations [6]. When *Salmonella* organisms isolated, quantitative culture was made. Five grams of feces was suspended into 20 ml of PBS to obtain a 1:5 dilution and a tenfold serial dilution was carried out up to 1:500. One ml of each dilution was transferred to 10 ml of Hajna tetrathionate broth. Five tubes were prepared for each dilution. After enrichment culture, isolation and identification were made followed by the manner exactly the same as mentioned above. The viable count of salmonellae was estimated by the method of the most probable number.

In case of the 2nd day, 12 (9.8%) of 123 samples were found to be positive, while 38 (40.4%) of 94 samples collected on the 5th day gave positive result (Table 1). There is the significant increase in the isolation rate on the 5th day than that on the 2nd day ($P<0.01$). *Salmonella* strains were divided into ten serovars, and the number of *S. choleraesuis* subspecies *choleraesuis* serovar Typhimurium (*S. Typhimurium*) increased on the 5th day (Table 2). As shown in Table 3, the number of the organism increased significantly on the 5th day than that on the 2nd

day ($P<0.05$). On the other hand, no such increase in the number was shown in the cases with the other *Salmonella* serovars ($P=0.05$).

Williams *et al.* [14] suggested that the isolation rate of *Salmonella* from the swine increased due to the stress of the carriage to the abattoir. However, it is still unknown whether the stress of detention influences the excretion of *Salmonella* from the detained dog or not. Many investigators reported that there are many detained dogs harbored salmonellae including *S. Typhimurium* in the mesenteric lymph node only after a few days detention [1, 4, 5, 9, 11]. Therefore, the stress due to detention should not influence significantly upon the excretion of *Salmonella* from the detained dog.

In this study, it was clear that rate of dogs harbored *S. Typhimurium* in the feces was increased remarkably during detention. This fact may be explained by cross-infection happened during detention. Tanaka *et al.* [12] described that carrier state in dogs was produced easily when a small amount of *S. Typhimurium* harbored in a canine feces was given orally. In the carrier dogs produced

Table 1. Isolation of *Salmonella* from the feces of dogs detained

| Day after detention | Number of samples | <i>Salmonella</i> positive | (%) |
|---------------------|-------------------|----------------------------|--------|
| 2nd day | 123 | 12 ^{a)} | (9.8) |
| 5th day | 94 | 38 ^{a)} | (40.4) |
| Total | 217 | 50 | (23.0) |

a) There was significant difference ($P<0.01$).

Table 2. *Salmonella* serovar isolated from the feces of dogs detained

| Serovar | Number of strain isolated | | Total |
|-----------------------|---------------------------|------------------------|-------|
| | 2nd day ^{a)} | 5 th day ^{a)} | |
| <i>S. Typhimurium</i> | 7 | 29 | 36 |
| <i>S. Thompson</i> | 0 | 4 | 4 |
| <i>S. Bareilly</i> | 2 | 1 | 3 |
| <i>S. Agona</i> | 1 | 2 | 3 |
| <i>S. Litchfield</i> | 0 | 2 | 2 |
| <i>S. Derby</i> | 0 | 2 | 2 |
| <i>S. Stanley</i> | 1 | 0 | 1 |
| <i>S. Infantis</i> | 1 | 0 | 1 |
| <i>S. Anatum</i> | 1 | 0 | 1 |
| <i>S. Livingstone</i> | 0 | 1 | 1 |

a) The day after detention.

Table 3. Number of *Salmonella* cells harbored in the feces of dogs detained

| Serovar | Day after detention | Viable number of <i>Salmonella</i> (MPN/100 g) | | | | | Total |
|-------------------------------------|---------------------|--|-----------------|-----------------|-----------------|-----------------------|-------|
| | | 10 ² > | 10 ² | 10 ³ | 10 ⁴ | 1.2×10 ⁵ < | |
| <i>S. Typhimurium</i> ^{a)} | 2nd day | 7 | | | | | 7 |
| | 5th day | 4 | 9 | 5 | 2 | 3 | 23 |
| Other serovar ^{b)} | 2nd day | 2 | 3 | 1 | | | 6 |
| | 5th day | 6 | 2 | 1 | 2 | 1 | 12 |

a) The number of the organism increased significantly on the 5th day than that on the 2nd day ($P>0.05$).

b) There was no increase of the number of the organism on the 5th day than that on the 2nd day ($P=0.05$).

experimentally, 10^2 – 10^5 MPN/100 g of *S. Typhimurium* was harbored in the feces of 5th day after administration [12]. In this experiment, 10^2 – 10^5 MPN/100 g of *S. Typhimurium* was also recovered from the feces collected on the 5th day after detention. The result indicates the onset of colonization in the intestine with the serovar.

Depending upon the results obtained in this study, it is suggested that the increase of isolation rate of *S. Typhimurium* from the detained dogs was due to cross-infection happened during detention. The ascending of the carrier rate was found only in the case with *S. Typhimurium*. The fact is attributable to the virulence of the serovar [12, 13].

ACKNOWLEDGEMENTS. Grateful acknowledgement are due to Dr. Sakazaki, National Institute of Health, Japan, who gave advice in the serological identification of salmonellae isolated. We wish to thank the staffs to Yokohama City Dog Center for their support to sampling.

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