

# Canine Salmonellosis: A Review and Report of Dog to Child Transmission of *Salmonella enteritidis*

ERSKINE V. MORSE, DVM, PhD, MARGO A. DUNCAN, DAVID A. ESTEP, MS,  
WENDELL A. RIGGS, MD, AND BILLIE O. BLACKBURN, DVM

## Introduction

The widespread and natural occurrence of canine *Salmonella* infections is well documented.<sup>1-11</sup> The enteric pathogens appear to have found a most suitable host in the dog. Since the animal will eat carrion and is coprophagic, ample opportunities for transmission and reinfection are continually presented. Most infections are inapparent and mild, and as such they are not detected nor recognized. Surveys of canine populations confirm that salmonellosis is no rarity. Probably 10 per cent of the dogs have experienced infection during their lifetimes.

## Discussion

*Salmonella* species readily colonize in the canine large intestine and mesenteric lymph nodes.<sup>6-9</sup> Fecal shedding of the pathogen(s) in naturally occurring infections probably continues for a period of at least 6 weeks. Since the lymph nodes harbor the agent, the carrier state may persist for much longer periods. Experimental canine infections with *S. infantis* have resulted in shedding of the organism for 117 days.<sup>12</sup> A carrier may not excrete salmonellae and hence is classed as noninfected. However, under stress or coincident with an enteric viral infection the salmonellae may leave the lymph nodes and reappear in the feces. Harrington reported<sup>13</sup> that 5.6 per cent of 1,182 swine tissues examined when hog cholera was suspected were mixed infections of hog cholera virus and salmonellae. An analogous situation may well exist in the case of canine distemper virus and *Salmonella* species.

The dog ranks second to the pig in the frequency of salmonellosis and the number of serotypes harbored according to Moran.<sup>14</sup> She found 23 different serotypes of *Salmonella* among 51 isolates. Galton et al<sup>7</sup> recovered 53 serotypes from canine feces or anal swabs. Salmonellae most frequently isolated from dogs in an area proved to be the same types seen most in man.<sup>7</sup> Canine salmonellosis is often complicated by simultaneous infection with two or more serotypes.<sup>7, 9, 15-17</sup> As many as four serotypes of salmonellae have been found in

an animal at one time.<sup>7</sup> Reinfection with another or new serotype, following the elimination of the original pathogen, is not to be overlooked.

Young and pregnant animals appear to be most susceptible to salmonellae.<sup>4, 18, 19</sup> Abortions, stillbirths, metritis, and death are not uncommon. Stucker, et al.<sup>20</sup> as well as Caraway, et al.<sup>16</sup> observed that canine salmonellosis was more prevalent in the fall and early winter, probably the principal, breeding or estral season for the dog. Both the male and female are very active and may roam widely at this time. Ample opportunity for contact and transmission is offered.

Signs of clinical salmonellosis in dogs include hyperpyrexia (104°-106° F), anorexia, diarrhea, bloody stools, vomiting, weight loss, cough, nasal hemorrhages, hyperirritability, incoordination, partial posterior paralysis, blindness, "running fits and barking", depression, and lochia.<sup>2, 16, 21, 22, 23</sup> The acute phase of the infection may last from four to ten days. Chronic intermittent diarrhea for three or four weeks may be the sequel. Probably the mortality in clinical cases does not exceed 10 per cent. It should be emphasized, however, that most salmonellae-infected dogs are asymptomatic and are long term, sporadic fecal shedders of the pathogen(s).<sup>12</sup>

A number of investigators have reported that dogs may serve as sources of salmonellosis for human beings. Possible episodes of canine to human transmission have involved many different serotypes.<sup>1, 3, 23, 27, 30, 31, 32, 35</sup> A recent minor epidemic/epizootic of *S. typhimurium* phage type 3 infection was described by Reynolds.<sup>33</sup> Three children, their mother, 6 dogs, and 3 cats were bacteriologically positive. Minced chicken scraps as well as raw meat and poultry consumption from a "nearby supplier" were found to contain *S. typhimurium*, phage type 3. The editors of *Morbidity and Mortality Weekly Reports*<sup>33</sup> commented: "This incident illustrates a common pathway of transmission of salmonellosis from contaminated animal food to pets to man."

The source of canine infections is difficult to determine. Prior to current processing procedures which involve adequate heating, prepared dog food meals, etc. could have served as sources of canine salmonellosis. Galton, et al<sup>36</sup> isolated 17 serotypes from 98 samples, of which 26.5 per cent were positive. *S. anatum*, *S. typhimurium*, *S. oranienburg* and *S. senftenberg* were predominate types isolated.

## A Case Report

### *Probable S. enteritidis* transmission from a dog to a child

On December 30, 1973 a 5½ year old male Dachshund was fed a chicken broth which had remained on the kitchen

Dr. Morse and Ms. Duncan are with the Department of Microbiology, Pathology and Public Health, School of Veterinary Medicine, and the Environmental Health Institute, Purdue University, Lafayette, IN 47907; Mr. Estep is with the Home Hospital Laboratories and Dr. Riggs is a pediatrician with the Arnett Clinic, both in Lafayette, IN; Dr. Blackburn is with the USDA Veterinary Services Laboratory (APHIS), Ames, IA.

First submitted in December, 1974, this paper was revised and accepted for publication in the Journal in August, 1975. Address reprint requests to Dr. Morse at Purdue University.

TABLE 1—Prevalence (Surveys) of Canine Salmonellosis

Investigators	Total Samples	Percent positive	Number serotypes isolated	Locale	Year
Wolff, A. H., <i>et al</i> <sup>1</sup>	100	18.0	16	Michigan	1948
Kintner, L. <sup>2</sup>	71	18.0	—	Ohio	1949
Watt, J. and De Capito, T. <sup>3</sup>	1156	3.4	19	Texas	1950
Adler, H. E., <i>et al</i> <sup>4</sup>	294	13.2	5	Honolulu	1951
Ball, M. R. <sup>5</sup>	259	6.2	8	Los Angeles	1951
	41	2.4	1	Bermuda	1951
Mann, P. H., <i>et al</i> <sup>6</sup>	50	12.0	6	N.Y. City	1953
Galton, M. M., <i>et al</i> <sup>7</sup>	8157	27.6	53	Florida	1955
Jungerman, P. F. & Grumbles, L. C. <sup>8</sup>	100	9.0	9	Texas	1960
Salmonella Surveillance Reports (HEW, CDC, Atlanta, Ga, 30333)	217	0.8-1.6	—	U.S. Nationally	1962-65 Incl. Reports
Khan, A. Q. <sup>9</sup>	442	23.4	46	Sudan	1970
Vaslin, F. <sup>10</sup>	91	0	—	Alfort, France	1971
Osman, B. <sup>11</sup>	1221	.005	4	Rural Tunisia	1971
	100	4.0	2	Urban Tunis	1971

stove for "one or two days." That evening and during the next 2 days the animal experienced severe nausea, vomiting, and a fetid, profuse diarrhea. The owner of the dog operated a baby-sitting service in her home and on January 2, 1974 a 16 months old girl, who was teething at the time, was brought on the premises. The child was in contact with the sick dog and the contaminated environment for several days. She was seen by the pediatrician (Riggs) at his office on January 7. The patient had been acutely ill for 24 hours at home with 105° F temperature, vomiting, and liquid stools. Admission to the hospital followed the office visit. At that time the blood count revealed: 9,800 W.B.C., hemoglobin 11.5 mg., hematocrit of 34, with 21 polymorphs, 29 bands, 47 lymphocytes and 2 monocytes. Urinalysis was normal. Hemoculture was taken, and later proved to be negative for *Salmonella*. Intramuscular injections of Ampicillin ®, 250 mg every 6 hours were commenced. Good clinical response to the antibiotic was observed, e.g. decrease in fever and number of stools. She was discharged from the hospital on January 11. Her stools were soft at this time and there was no fever.

On January 7 *Salmonella enteritidis* was isolated from an anal swab from the child which had been taken during hospitalization. It is interesting to note that the isolate was sensitive to the following antimicrobials: Ampicillin ®, sulfonamides, Furadantin/Macrodantin ®, Chloramphenicol ®, Neomycin ®, Polymyxin B ®, Nalidixic Acid ®, Gentamicin ®, Kanamycin ®, Streptomycin ®, Novobiocin ® and chlortetracycline. As of January 23 the subject still was "not eating well" and had 3 bowel evacuations daily. Shortly thereafter, the youngster made an uneventful recovery.

By January 14 the dog appeared clinically normal. *S. enteritidis* was isolated upon a direct plating of canine feces upon Brilliant Green Agar plates (Difco) and Hektoen Enteric Agar plates (Difco). Following request by the owner the dog was euthanized and on January 22 necropsy and bacteriological examinations were conducted. The spleen, mesenteric lymph nodes, and the contents of both the large and small intestines contained salmonellae. The lungs, heartblood, gall bladder, and urinary bladder were negative upon culture for salmonellae. Selenite and Tetrathionate enrichment broth

were inoculated with tissues, incubated at 37° C and sub-cultured at 24 and 48 hours to both Brilliant Green and Hektoen Enteric Agar Plates. The plates were incubated at 37° C and examined for salmonellae colonies at 24 and 48 hours.

The *S. enteritidis* cultures obtained from the dog presented an identical antimicrobial sensitivity pattern to that from the child with one exception: the dog isolate was resistant to sulfonamides. *Enterobacter hafnia* and *Escherichia coli*, also isolates from the canine feces, had identical antimicrobial sensitivity patterns to those of the *S. enteritidis* canine culture.

Pathological changes observed at the canine necropsy showed characteristic salmonellosis lesions of catarrhal, hemorrhagic enteritis with mucosal sloughing and periodic denuded portions of the gut.

In all probability the child became infected through contact with the dog and its excreta. Since the youngster was "teething" at the time this may have played a contributory or stress role leading to increased susceptibility and transmission of the infection. It is apparent that dogs may serve as a source of human salmonellosis—especially for young children.

### Summary

Dogs have been shown to harbor 53 salmonellae serotypes. Multiple simultaneous infections with 2 to 4 serotypes have been observed. The prevalence of canine salmonellosis may be as high as 27 per cent. *Salmonella typhimurium* and *S. anatum* are the most common etiologic agents. Dogs commonly experience a sub-clinical course of salmonellosis. Some investigators state that the dog may serve as a source of human infections. A few reports in the literature have documented this fact. The transmission of *S. enteritidis* from dog to child is described in this article.

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*When the fetus, leaving the upper part, has descended into the lower abdomen, the head has become fixed in the pelvis and her labor pains have become more rapid, then the physician should know that the fetus has turned over and come down. At this stage she should be placed on the bed-stead and the delivery treatment begun. In her ear the favourite lady attendant should utter the following chant:—"May the earth, the waters, the heavens, the light, the wind, Visnu and Prajāpati ever protect you and the child and may they direct the delivery. O, auspicious-faced one! bring forth without distress to yourself or to him, a son who will possess the lustre of Kārtikēya and will have the protection of Kārtikēya."*

from: The Caraka Samhita  
(Ayurvedic medicine)  
Shree Gulabkunverba Ayurvedil Society  
Jamnagar, India, 1949