



# Disease Caused by *Salmonella*, a Type of Bacteria (Salmonellosis)

## Basics

### OVERVIEW

- “Salmonellosis” is a bacterial disease caused by many different serotypes of *Salmonella*; “serotypes” are subdivisions of a species that are different from other strains
- *Salmonella* infection may cause inflammation of the intestines (known as “enteritis”), generalized disease secondary to spread of bacteria in the blood (known as “septicemia” or “blood poisoning”), and abortions

### SIGNALMENT/DESCRIPTION OF PET

#### Species

- Dogs
- Cats

#### Breed Predispositions

- *Salmonella* commonly found in bowel movement of racing greyhounds and racing sled dogs fed raw meat diets; presence of *Salmonella* does not necessarily imply infection, but could reflect transit of bacteria from the raw meat through digestive tract

#### Mean Age and Range

- Dogs—clinical disease is seen in newborn or immature puppies and in pregnant female dogs (known as “bitches”); most adult carrier dogs clinically are normal; a “carrier state” is one in which the dog has no signs of disease but harbors *Salmonella* and can transmit it to other animals
- Cats—adults are highly resistant; stressed, hospitalized cats are at high risk, especially when treated with antibiotics prior to surgery or dental procedures

### SIGNS/OBSERVED CHANGES IN THE PET

- Disease severity varies; animal may be infected, but has no signs of disease (known as a “subclinical infection”) leading to a carrier state, in which the animal harbors *Salmonella*, sheds it in bowel movement and thus transmits it to other animals; mild, moderate, and severe clinical cases may be seen in newborns and stressed adult dogs and cats
- Subclinical infection more common than clinical disease, which is rare
- Carrier animals—no clinical signs
- Diarrhea with mucus and/or blood
- Vomiting

- Dehydration
- Fever
- General signs of discomfort and “not feeling well” (known as “malaise”)
- Lack of appetite (known as “anorexia”)
- Sluggishness (lethargy), depression
- Abdominal pain
- Weight loss
- Vaginal discharge/abortion—dogs
- Pets with the presence of bacteria in the blood (known as “bacteremia”) and generalized disease caused by the spread of bacteria in the blood (septicemia or blood poisoning); shock associated with generalized bacterial infection (sepsis; condition known as “septic shock”); or the presence of bacterial toxins in the blood [known as “endotoxemia”]—pale gums and moist tissues of the body (known as “mucous membranes”); weakness; circulatory collapse; rapid heart rate (known as “tachycardia”); rapid breathing (known as “tachypnea”)
- Localized infections outside of the intestinal tract—inflammation of the moist tissues of the eye (known as “conjunctivitis”); uterus/abortion; inflammation of the tissues under the skin that tends to spread (known as “cellulitis”); infection/inflammation of the lining of the chest, leading to accumulation of pus in the space between the chest wall and the lungs (condition known as “pyothorax”)
- Cats—may exhibit syndrome of a long-term (chronic) illness (without gastrointestinal signs) characterized by persistent fever; prolonged illness with vague, nonspecific clinical signs; and abnormal white-blood cell count
- Recovering pets—may exhibit long-term (chronic) intermittent diarrhea for 3–4 weeks; may shed *Salmonella* in bowel movement for 6 weeks or longer

## CAUSES

- Any one of more than 2,000 serotypes of *Salmonella*; “serotypes” are subdivisions of species that are different from other strains
- Two or more simultaneous serotypes in a host animal are not uncommon

## RISK FACTORS

### Disease Agent

- *Salmonella* serotype—variable disease-causing factors, infectious dose, and route of exposure
- Host factors that increase likelihood of developing clinical signs
- Age—newborn or young dogs and cats; immature immune system
- Overall health status—debilitated young animals or adults: other coexistent disease, presence of parasites; young animals: immature gastrointestinal tract, poorly developed normal intestinal bacteria
- Disrupted gastrointestinal bacteria flora (adult cats)—antibiotic treatment; subsequent exposure to *Salmonella* during hospitalization

### Environmental Factors

- Eating of feces or bowel movement (known as “coprophagia”)—spreads infection
- Dehydrated pet food—may harbor *Salmonella*; kibble and dog biscuits usually not as risky
- Pig-ear dog treats contaminated by *Salmonella*
- Feeding commercial raw meat diets (especially chicken) to dogs and cats—bacteria (*Salmonella*, *Campylobacter*, and *Clostridium perfringens*) have been found in raw meat diets
- Horse meat fed to exotic cats
- Grooming habits—may result in *Salmonella*-contaminated hair coat, which contaminates cage or run environment, feed and water dishes
- Dense population of animals—kennels/boarding facilities, shelters, catteries; overcrowded housing; unsanitary conditions; exposure to other infected (or carrier) animals—buildup of *Salmonella* in the environment; increased opportunity for exposure to *Salmonella*; stress factors

### Hunting/Stray Animals

- Scavenging for food—exposure to garbage, contaminated food/water, dead animals
- Exposure to other infected (or carrier) animals
- Exposure to infected raw meat

### Hospitalized Pets

- Exposure of hospitalized pet to *Salmonella* during a period of stress or activation (by stress) of pre-existing carrier *Salmonella* infection, especially in pets treated with antibiotics

### **Vaccinations**

- Death in kittens (likely to be infected by *Salmonella*, but not showing signs [subclinical infection]) following vaccination with some types of panleukopenia vaccine

## **Treatment**

### **HEALTH CARE**

- Outpatient—uncomplicated intestinal disease (without the presence of bacteria in the blood [bacteremia]) and carrier states; a “carrier state” is one in which the animal has no signs of disease but harbors *Salmonella* and can transmit it to other animals
- Inpatient—with presence of bacteria in the blood (bacteremia) and/or generalized disease caused by the spread of bacteria in the blood (septicemia or blood poisoning) and for inflammation of the stomach and intestines (known as “gastroenteritis”) in newborns and immature animals that are debilitated rapidly by diarrhea
- Varies according to severity of illness—assess dehydration, body weight, ongoing fluid loss, shock, packed cell volume (PCV, a means of measuring the percentage volume of red-blood cells as compared to the fluid volume of blood) and total protein (a quick laboratory test that provides general information on the level of protein in the fluid portion of the blood), electrolytes, acid–base status

### **Uncomplicated Inflammation of the Stomach and Intestines (Gastroenteritis)**

- Supportive care—fluid and electrolyte replacement
- Balanced fluids (such as lactated Ringer's solution), administered intravenously
- Oral fluids—special glucose solutions; for secretory diarrhea
- Plasma transfusions—if serum albumin (a protein in the blood) is less than 2 g/dl

### **Newborns, Aged, and Debilitated Pets**

- Plasma transfusions
- Supportive care—as for uncomplicated gastroenteritis

### **ACTIVITY**

- Isolate inpatients—all pets in sudden (acute) stage of disease may shed a large number of *Salmonella* in their bowel movement
- Restrict activity with cage rest, monitor, and provide warmth—suddenly (acutely) ill pets; pets with bacteria in their blood (bacteremia) or generalized disease caused by the spread of bacteria in the blood (septicemia or blood poisoning); and pets that have been ill for a long time (chronically ill pets)

### **DIET**

- Restrict food for 24–48 hours; gradually introduce a highly digestible, low-fat diet

## **Medications**

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive

### **CARRIER STATE**

- The animal has no signs of disease but harbors *Salmonella* and can transmit it to other animals
- Antibiotics—should not be administered
- Quinolone drugs—demonstrated clearing of carrier states in people; more controlled trials in animals needed
- Uncomplicated Inflammation of the Stomach and Intestines (Gastroenteritis)
- Antibiotics not indicated
- Locally acting medications to protect the lining of the intestines

### **NEWBORNS, AGED, AND DEBILITATED PETS**

- Steroids—shown to reduce death rate in pets with shock due to the presence of bacterial toxins in the blood (known as “endotoxic shock”)

- Antibiotics—should be administered; ideally, perform bacterial culture and sensitivity testing to determine appropriate antibiotic; examples include trimethoprim-sulfa, enrofloxacin, norfloxacin, and chloramphenicol

## Follow-Up Care

### PATIENT MONITORING

- Fecal bacterial culture to check for *Salmonella* in the bowel movement—repeat monthly for few months to assess development of carrier state
- Other animals—monitor for secondary spread of infection
- Contact your pet's veterinarian, if the pet shows signs of recurring disease

### PREVENTIONS AND AVOIDANCE

- Keep pets healthy—proper nutrition; avoid raw meat diets; vaccinate for other infectious diseases; clean and disinfect cages, runs, and food and water dishes frequently; store food and feeding utensils properly
- Reduce overcrowding—kennels/boarding facilities, shelters, and catteries
- New arrivals—isolate and screen; monitor for sickness before introducing them to other pets
- Experimental live attenuated vaccine shows promise, especially for racing dogs
- Important to protect pets being treated with antibiotics from exposure to a *Salmonella*-contaminated environment

### POSSIBLE COMPLICATIONS

- Spread of infection within the household to other pets or to people is not uncommon
- Development of long-term (chronic) infection with diarrhea
- Recurrence of disease with stress
- Death

### EXPECTED COURSE AND PROGNOSIS

- Uncomplicated inflammation of the stomach and intestines (gastroenteritis)—prognosis excellent; frequently self-limited; pets recover with good nursing care
- Recovered pets may shed *Salmonella* intermittently for months or longer as a recovered carrier (the pet has no signs of disease but harbors *Salmonella* and can transmit it to other animals)
- Newborn, aged, stressed pets—can develop generalized disease caused by the spread of bacteria in the blood (septicemia or blood poisoning); can be severe and debilitating; may lead to death, if untreated

## Key Points

- People should wash hands frequently
- Restrict access to the pet in sudden (acute) stages of the disease
- A large number of *Salmonella* may be shed in the bowel movement; recovered pets may shed *Salmonella* intermittently for months or longer as a recovered carrier
- A “carrier state” is one in which the animal has no signs of disease but harbors *Salmonella* and can transmit it to other animals or people

# Notes

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