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Paratuberculosis (*Johne's Disease*)

AUBREY B. LARSEN AND HOWARD W. JOHNSON

JOHNE'S disease (paratuberculosis) was diagnosed for the first time in the United States in 1908 and since has been reported in almost every State.

The yearly death loss from the disease may vary from 2 to 10 percent of the animals in the herd. Usually only 1 or 2 animals are sick at one time.

The period of incubation is usually a year or longer. Animals may remain infected for years without showing any outward signs of the disease. Symptoms are usually seen in animals 2 to 6 years old. Calving, with a subsequent heavy milk production, tends to lower the resistance of cows, so that they often develop symptoms of the disease at any time during the year. Symptoms are more likely to develop during periods when the herd is consuming feeds with a laxative effect, such as lush pastures, however. Change in environment, such as that resulting from transfer through sale, also seems to be a factor.

TYPICAL SYMPTOMS include a persistent diarrhea. The excretion has a fetid odor. Straining is not observed. The diarrhea responds only temporarily or not at all to usual treatments for such conditions. A rapid loss of flesh accompanies the diarrhea. Occasionally a gradual loss of weight may precede the diarrhea by a month or more.

An infected animal develops an unthrifty appearance. It has a rough hair coat, which does not shed with the change of season. The skin loses its normal texture, becomes dry, and adheres tightly to the body. The appetite remains normal in the early stages. The milk flow drops or stops entirely. The diseased animal maintains a normal body temperature, but it continues to scour and waste away until it becomes extremely thin.

Temporary improvement is not uncommon—the animal may gain weight and appear to be on the road to recovery, only to start scouring again and eventually die. A complete recovery from an advanced stage of the disease is rare.

Symptoms similar to those observed in Johne's disease sometimes attend such conditions as coccidiosis, malnutrition, winter dysentery, pyelonephritis (a type of kidney infection), abscessed liver, and parasitism. A thorough examination of the animal and the husbandry practiced on the premises often is necessary before one can make a diagnosis.

The causative organism is a short, plump, acid-fast bacillus. When it is stained with a suitable dye, such as carbol fuchsin, the color cannot be removed from the bacillus by the action

of acids diluted in alcohol. It is therefore described as "acidfast."

The bacillus is found in typical clumps in stained smears prepared from the intestinal mucosa or adjacent lymph glands of diseased animals. It occurs in greatest numbers in the region of the ileocaecal valve, which connects the large and small intestines, although the habitat may extend from the rectum to the upper part of the small intestine. Microscopic studies of stained pathological sections show the bacillus to be both inside and outside of the cells in the tissues.

The causative organism is excreted with the feces and will live outside the animal's body for a year or even longer. It is not killed by disinfectants containing chlorine as the active ingredient or by lye solutions. The bacillus is killed by a 3-percent solution of cresylic acid disinfectant or a 1-percent solution of sodium orthophenylphenate.

The disease cannot be established in small animals in the laboratory. It is hard to isolate the bacillus and cultivate it on artificial media. Primary isolation is accomplished by adding to the medium an essential growth factor found in *Mycobacterium phlei* (timothy hay bacillus).

A diagnosis of Johne's disease should be confirmed if possible by demonstrating the causative bacillus, *M. paratuberculosis*, in stained preparations (prepared from either small bits of the intestinal mucosa picked off the wall of the rectum or from droppings) and by obtaining a positive reaction to a skin test with johnin.

The diagnostic agent—johnin—is prepared from *M. paratuberculosis* bacilli that have been adapted to grow on liquid media. To prepare johnin, the bacilli are incubated at 38° C. until satisfactory growth has been obtained. The bacilli are then killed by steam sterilization and discarded after filtering. The medium is concentrated; chemicals are added; it is refiltered; and the finished product is tested for sterility and potency.

Animals showing clinical evidence of Johne's disease usually die, so a post-mortem examination should be conducted to confirm the diagnosis. Except for extreme emaciation of the carcass, little evidence of the disease is observed grossly. The small intestine may feel soft and thick to the touch and the adjacent lymph glands may be swollen. The ileocaecal valve is often inflamed and larger than normal. The intestinal mucosa may be thrown up in irregular reddened folds several times its normal thickness. However, lesions alone should not be relied upon, and, before reaching a diagnosis, the causative bacillus should be demonstrated microscopically in smears or pathological sections prepared from the lesions.

TREATMENT OF CLINICAL Johne's disease has not been successful, probably because it is a chronic disease often diagnosed only in the terminal stage. Such agents as streptomycin, viomycin, 4:4' diamino sulfone, isonicotinic acid hydrazide, and others that have been found useful in the treatment of other diseases caused by acid-fast bacilli have been tried without success in the treatment of Johne's disease. Vaccines have also been tried, but the methods of vaccination now available sometimes cause vaccinated animals to react positively to the tuberculin test.

Since medicinal treatment cannot be used successfully to treat the disease, one must depend on other measures for keeping it under control. When Johne's disease is diagnosed in a herd for the first time, johnin tests should be conducted on all animals in the herd to determine the extent of the infection.

To conduct the johnin test, 0.2 cubic centimeter of johnin is injected in the skin of either the neck or the caudal fold. The injection site is examined 48 hours later for evidence of a reaction. An increase of 3 millimeters over the original skin thickness indicates a positive reaction.

If the number of reactors to the test is not large, they (and all animals showing clinical evidence of the disease) should be removed at once and slaughtered.

If a large number of reactors is disclosed on the initial test, disposing of them at once may be too heavy a loss to the owner. He may decide to take immediate steps to eliminate only the animals that show clinical symptoms of the disease and to dispose of the remaining reactors by slaughter as rapidly as young animals can be raised for replacement. This procedure involves a risk, as reacting animals may spread the disease even though they show no symptoms. Breeding stock should not be sold as long as reacting animals remain in the herd.

Because the disease is spread by the droppings of infected animals, precautions must be taken to keep susceptible animals from swallowing contaminated manure and from being exposed to drainage from the manure.

As calves are more easily infected with *Johne's* disease than older animals, it is important to raise calves in quarters that have not been contaminated by infected animals. Calves should be removed from their dams within 12 hours after birth, placed in clean quarters, and cared for by attendants whose footgear is cleaned and disinfected each time they enter the quarters. Separate feeding and cleaning equipment should be provided for the calf-rearing quarters. The equipment should never be exchanged with that used in caring for mature animals. All feeding and watering equipment used for mature cattle should be so constructed that fecal contamination of feed and water is prevented. Equipment used in cleaning out stables should never be exchanged with equipment used in feed rooms and alleys. Foot baths containing suitable disinfectants should be placed at the entrances to feed alleys and feedrooms. Attendants should disinfect footwear in these containers.

Immediately after the removal of

infected animals, the premises should be disinfected. A disinfectant approved by the Department of Agriculture, such as a 1-percent solution of sodium orthophenylphenate, should be applied to all mangers, pens, troughs, walls, and floors. Stagnant water holes should be fenced off or drained. All lots used by infected animals should have all manure and a thin layer of topsoil removed and fences arranged so that all parts of the lot are exposed to direct sunlight at some period of the day. Johnin tests should be conducted periodically on all animals in the herd. If negative results are obtained on three successive tests at intervals of 6 months and no clinical symptoms have been observed, the herd is considered free of the disease.

SHEEP AND GOATS sometimes contract *Johne's* disease. As in cattle, the disease is diagnosed from symptoms and by demonstrating the acid-fast bacillus in the droppings or intestinal lining. It is difficult to control the disease in sheep and goats, and the entire flock sometimes is slaughtered and replaced with healthy animals.

The Department of Agriculture has started research to find methods that we hope will eventually eliminate the disease. One result of the research was the development of methods of growing the bacillus in large amounts in the laboratory. These cultures are used in preparing various products that have been used experimentally as diagnostic and immunizing agents.

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