

Johne's Disease

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THE WORD "INSIDIOUS" can truly be applied to Johne's disease. It creeps up unobserved, the symptoms are mild at first and the end is death. It is one of the most difficult of diseases to eradicate from a herd—and apparently it is increasing in the United States. The authors tell what is known and what is not known about it.

JOHNE'S DISEASE, or paratuberculosis, is a chronic infection characterized principally by inflammation of the intestines, loss of condition, and diarrhea. It attacks cattle and sheep and has been reported in goats, deer, and horses. So far as is known, man is not susceptible. The disease is very widespread, having been observed in practically every country where cattle are raised on a large scale. It occurs very frequently in districts such as western continental Europe and the British Isles, where intensive dairying is practiced.

While Johne's disease has been found in both beef and dairy cattle in every part of the United States, accurate figures showing its extent in this country are not available. Both tests of live cattle with johnin (a diagnostic agent similar to tuberculin, prepared from cultures of the causative bacillus) and examinations of slaughtered cattle at packing plants have indicated that the disease is much more prevalent than most veterinarians and livestock sanitary authorities have realized. About 5,000 head of cattle, most of which were in dairy herds, were tested recently in the Southeastern States, and over 100 percent gave positive reactions.

There are very few records of the occurrence of the disease in sheep in the United States, but only a few investigators have examined sheep for the disease.

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CAUSE OF THE DISEASE

The causative agent of Johne's disease is a bacillus named *Mycobacterium paratuberculosis*, which is usually found in scrapings from affected parts of the intestinal mucous membrane and in the mesenteric lymph glands.² This organism does not grow readily on the commonly used laboratory culture media. Even on media especially adapted to it, it grows very slowly when first isolated from the tissues of diseased animals; hence obtaining cultures is a difficult and laborious procedure. After growing on laboratory media for several generations, however, the organism becomes adapted to such media and grows fairly well. So far as is known, it does not multiply outside the body of a host animal.

Attempts at infecting laboratory animals have met with little success. If the organisms are suspended in oil and injected intraperitoneally (into the lining of the abdominal cavity) into guinea pigs, local lesions, or tissue injuries, usually develop on the liver, spleen, and omentum, but a progressive disease does not follow. The rabbit gives even less response. The chicken appears to be somewhat more susceptible than the guinea pig, but shows little evidence of a progressive disease.

MODE OF INFECTION

Since the Johne's disease organism lives in the mucous membrane of the intestines of infected cattle and sheep, large numbers may be present in the feces of diseased animals, and it is generally believed that this is the principal source of infection. Exposure may come from direct contact between infected and susceptible animals or through the use by susceptible animals of pens, pastures, corrals, or barns that have been contaminated by diseased cattle or sheep. A contaminated water supply may be a potent source of the disease.

It is very generally believed that young animals are more susceptible than mature ones and that the route of infection is through the digestive tract.

In most herds the disease spreads rather slowly. Even where Johne's disease has been known to be present for many years and there has been no segregation of the infected cattle, it is rather unusual to find as many as half the herd affected.

Several months to several years may pass following exposure before infected cattle show clinical symptoms. Many such animals carry large numbers of the Johne's disease organism in their intestines and may be potent in spreading the disease.

SYMPTOMS

Symptoms of Johne's disease are seldom observed in cattle under 1 to 2 years of age; there are very few records of the disease in steers or in heifers before their first calves are born. Probably the ordeal of freshening makes the infected cow more susceptible to

² *Mycobacterium paratuberculosis* is aerobic, nonmotile, sporeless, and acid-fast.

the ravages of paratuberculosis, for the clinical symptoms often appear for the first time within 2 to 5 or 6 weeks following calving.

The symptoms that are considered typical consist in gradual loss of flesh to the point of emaciation, and intermittent diarrhea becoming gradually worse. In most instances the temperature remains practically normal. The appetite is usually fairly good until the disease is well advanced, and there is little or no apparent disturbance of the respiratory, circulatory, and urinary systems. During attacks of diarrhea there is some increase in thirst. The decline in general condition is usually accompanied by a roughening of the coat and drying of the skin. Diarrhea may not appear until the animal has lost considerable weight. The semiliquid or liquid feces are usually free from blood and in most instances do not have a very foul odor until the disease is well advanced. Large numbers of gas bubbles may appear in the feces, but this is not very common. There may seem to be improvement, but it is usually very temporary. The tendency is for the attacks of diarrhea to become more frequent and severe until death occurs.

DIAGNOSIS

Diagnosis of Johne's disease has always been somewhat difficult. Many infected animals that may be active spreaders of the disease show no clinical symptoms. Even those exhibiting symptoms may be suspected of suffering from malnutrition, parasitism, chronic indigestion, or chronic poisoning. Attempts at finding acid-fast organisms in either the feces or scrapings from the rectum are sometimes successful, but in many known cases results have been negative.

The use of diagnostic agents similar to tuberculin has given encouraging results. The materials used and the methods of injection have varied with different workers. Twort and Ingram prepared johnin in the same manner as tuberculin and injected it subcutaneously (under the skin). Hastings, Beach, and Hadley used avian tuberculin subcutaneously, and Hagan and Zeissig injected it intravenously (into the veins). The reactions from these injections are a rise in temperature and, in some animals, a general systemic upset.

Intradermic injections (into, not under the skin) of johnin in infected cattle have resulted in local reactions comparable to those seen in tuberculous cattle following the intradermic injection of tuberculin. The reactions appeared in 1 to 3 days and disappeared slowly, but the seventy-second hour after injection is apparently the best time to observe results. The minimal enlargement that is considered a reaction to johnin is smaller than that interpreted as a reaction in tuberculin testing, and the swelling also tends to be somewhat more diffuse than that in tuberculin reactors. Observations indicate that the intradermic injection of johnin does not cause a physical break-down in infected animals.

Practically all workers agree that animals that react to any of the Johne's disease tests are, in a high percentage of the cases, infected. The weakness in diagnosis with the tests is that some infected animals fail to react.

Since the organism causing Johne's disease is similar to that causing tuberculosis, there has been much interest in the possibility that animals affected with one of these diseases might react to tests for the other. Some cattle that have given typical reactions when tested with tuberculin have shown the presence of Johne's disease instead of tuberculosis on post mortem examination. In some herds cattle with no visible lesions have repeatedly reacted to tuberculin over a period of years, and it has been established that paratuberculosis is present in such reactors.

TREATMENT

No satisfactory method of treating cattle affected with Johne's disease has been found. Some animals respond temporarily to a change in feed and treatment with intestinal astringents soon after symptoms appear. Some veterinarians have recommended that animals showing clinical symptoms be taken off pasture and given dry, nutritious feed, while others state that an alleviation of symptoms is frequently observed if affected cattle are placed on good pasture. All agree that any improvement is soon followed by a recurrence of symptoms. Practically all cattle that develop clinical symptoms die within a period that varies between 1 month and 2 years. It is usually recommended, therefore, that animals showing symptoms of Johne's disease be sold for beef while they are still in good condition. Since the disease is not transmissible to man and the lesions do not involve any of the edible parts, the carcasses of affected cattle in good condition at the time of slaughter, if they show no indication of any other disease, are passed as wholesome food.

POST MORTEM FINDINGS

The pathology of Johne's disease is restricted to the digestive tract and adjacent lymphatic glands. Both the location and the type of the lesions vary somewhat in animals of different ages. In young calves the entire small intestine may be involved, while in mature animals the lesions are usually restricted to the ileum, cecum, colon, and rectum. In calves the principal changes observed on autopsy are those accompanying acute congestion. There is redness and some swelling of the mucous membrane of the affected portion of the small intestine. In some cases only a small area is involved.

The changes found in mature cattle indicate a much more chronic disease. The lesions consist principally of a marked thickening of the affected mucous membrane, with some reddened patches and some enlargement of the adjacent lymph nodes. In severe cases of long standing the mucous membrane may be 2 to 5 times its normal thickness. The thickened portions lie in folds, as if the lining membrane were too large. There may be few or many reddened patches, and they vary greatly in size and characteristics. Some are rather sharply outlined; others are diffuse. In some cases these changes involve the mucous membrane of almost the entire ileum, cecum, colon, and rectum, while in others only a small area may be affected. In mature cattle, lesions are found most frequently in close proximity to the ileo-cecal valve. Smears made from the thickened, and reddened areas may reveal typical slender, rod-shaped, acid-fast bacteria, usually occurring in nests or clumps.

In some infected animals the organisms are very plentiful, while in others they are very scarce. There seems to be little relation between the severity of the lesions and the number of bacteria found on smears from them. Neither is there any marked relationship between the severity of the symptoms and

the extent of the lesions. Some of the most severe advanced cases may have very slight lesions.

The thickening and fold formation just described are not necessarily indicative of Johne's disease. Such changes have been found in the mucous membranes of the intestines of many cattle which had passed johnin tests and in which the paratuberculosis organisms could not be found. It has been impossible to differentiate by macroscopic examination of the tissues between the lesions in cattle free from Johne's disease and those in affected cattle.

In sheep there are even fewer changes than in cattle. Reacting sheep in which Johne's disease organisms have been demonstrated have had only a slight thickening or reddening of the mucosa of the intestines. Lesions have not been found in any other organs of sheep.

CONTROL AND ERADICATION

Since there is no known method of treating Johne's disease successfully, any effective control must consist in preventing exposure of susceptible, healthy animals. Owners of herds of cattle in which the disease has not appeared should take every precaution to prevent its introduction. If it is necessary to introduce new animals into a herd, they should be procured from reputable breeders, and it would be well to make special inquiry concerning Johne's disease. Such a breeder can usually furnish a statement from an accredited veterinarian concerning the health of the herd from which purchases are contemplated, with a specific statement in regard to clinical symptoms of Johne's disease. Though such precautions may seem unnecessary, it is much less expensive in both time and money to prevent the introduction of this insidious disease than to eradicate it after it becomes established in a herd.

The owner of any herd in which losses from Johne's disease are occurring should realize that, unless it is controlled, it is likely to become increasingly destructive until the herd becomes economically unprofitable. He should realize, too, that it is one of the most difficult of the infectious diseases to eradicate and that eradication will probably require at least 2 years of constant effort. The mere removal of cattle showing clinical symptoms will not usually bring relief, for too many apparently healthy animals are potential spreaders of the organisms. Although the johnin test is still not perfect, it has enough merit to justify its use in infected herds. The control program that is most likely to succeed would include testing at regular intervals, preferably every 3 to 6 months; removing all reactors whether or not they were showing symptoms; cleaning and disinfecting thoroughly after any affected or reacting animal is removed from a barn or lot; and, most important of all, rearing young breeding stock in quarters that have not been used by mature animals.

Some cattle showing typical symptoms fail to react to the test. In any successful control program all such animals must be considered sources of infection.

Stanchions, stalls, barns, pens, and corrals in which affected cattle have been kept should be thoroughly cleaned, and all wood or concrete mangers, drinking troughs, and floors should be soaked for several hours in some disinfectant approved for tuberculosis-eradication work. Pens and corrals which have been used for such

animals should have all the manure and at least 4 inches of the topsoil removed. This should be either buried or placed in a field to which cattle will not have access. Care should be taken that drainage from such a field does not contaminate pastures, streams, or pens that may be used by healthy cattle.

Since the organisms of Johne's disease are excreted in the feces, special precautions should be taken to prevent contamination of any feed or water with cattle droppings. Cattle should not be allowed in feed alleys. Brooms for cleaning gutters, floors, and stanchion platforms should be used for this purpose only, and a different set should be used for the mangers, feed alleys, and feed trucks. Caretakers should be careful not to contaminate hay, grain, silage, or other feed with infective material carried on their feet. All too frequently herdsmen climb into a haymow or a silo without cleaning their boots or shoes.

Water from pools, ponds, sloughs, and streams that receive surface drainage from lots or pastures that have been used by an infected herd is unsafe. On infected premises great care should be taken to prevent contamination of any pails or buckets from which young calves are to be fed.

During the past several years cattlemen have from time to time raised the question of the desirability of regulations requiring testing for Johne's disease as a prerequisite for interstate shipment. Livestock sanitary officials and authorities seem agreed that such a requirement is not now advisable because definite information that such tests are reliable is lacking. In several States indemnities for cattle slaughtered on account of Johne's disease are paid on the same basis as the indemnities for slaughtered tuberculous cattle. The Bureau of Animal Industry has been granted authority by Congress to pay indemnity to cattle owners for animals that are slaughtered because of reaction to the johnin test, and the payments are made on the same basis as those on tuberculous cattle. Indemnity funds have been available for this purpose since July 1, 1927, and a number of livestock owners have received benefits from them.

Although specific figures are not available to prove it, many veterinarians and livestock sanitary officers believe that Johne's disease is increasing in the United States and that unless something is done to stop the increase the disease will become as serious a menace in this country as it is in some parts of Europe. Much more research is necessary, however, before definite knowledge that can be used to control and eradicate the disease completely will be available.