Enteritis of Swine

THREE VERY SERIOUS FORMS of intestinal inflammation—necrotic enteritis, swine dysentery, and enteritis of young pigs—are considered here. The first two are especially deadly in combination with hog cholera. Everything that is known about these maladies indicates that the heavy losses they cause could be largely prevented by really good swine husbandry.

The term "enteritis" means an inflammation of the intestines. There are many kinds of enteritis affecting swine, and they vary in intensity. Two of the most serious are necrotic enteritis and swine dysentery.

NECROTIC ENTERITIS

Necrotic enteritis has until recently been considered an infectious disease of swine caused by the micro-organism Salmonella choleraesuis. Lately, however, the relation of swine nutrition to the development of this disease has been given prominent attention. The results of investigations now in progress in different sections of the country may clarify the question of the cause of the disease.

Necrotic enteritis has also been called necro, paratyphoid, caseous enteritis, and infectious necrotic enteritis. The term "necrotic enteritis" means an inflammation of the intestines (enteritis) characterized by dead cells or tissue (necrosis). Besides being a specific disease of swine, necrotic enteritis is also a condition associated with other diseases.

THE CAUSAL ORGANISM

The disease was first described as early as 1866 (4). Later it was associated with hog cholera. After it had been determined that hog cholera was caused by a filtrable virus, further investigation revealed that necrotic enteritis occurred as an independent disease and was

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2 Italic numbers in parentheses refer to Literature Cited, p. 702.
caused by the micro-organism *Salmonella choleraesuis* (literally, swine-cholera *Salmonella*) which has also been called *Bacterium choleraesuis*, *Bacillus suipestifer*, and still later *Salmonella suipestifer*.

In the United States, Murray and associates (5, 6) and Biester and associates (7) have described extensive investigations of the disease. These investigators were able to produce it in more than 100 pigs by feeding them cultures of the organism. They also isolated the causal organism from all of the field cases that were investigated. A number of other investigators have also shown that necrotic enteritis can be produced by feeding cultures.

Examinations of the bacterial flora of the intestines of apparently healthy swine for the presence of the paratyphoid organism show that relatively few normal pigs harbor the organism. It has been found in a sufficient number, however, to indicate that there may be a carrier type in which the organism is present without causing any appreciable injury. Some change may take place in such an animal that may provide conditions necessary for the organism to become active.

The organism is known to be highly virulent in the presence of hog cholera infection. Thus, when a pig that has been harboring the *Salmonella* organism without appreciable damage becomes infected with hog cholera virus, the paratyphoid organism invades the body tissues and produces definite lesions. Animals affected with both hog cholera virus and *Salmonella choleraesuis* generally die within 5 to 7 days, whereas hog cholera infection alone usually requires about 15 days to cause death. The combined infections spread from animal to animal, producing a very severe, fatal disease. *S. choleraesuis* has been considered to play a part in so-called hog cholera "breaks" (see the article on Hog Cholera, p. 673), and the greatest precautions should be taken in immunizing pigs with hog cholera virus and anti-hog-cholera serum when there is a possibility that this paratyphoid organism is present in the herd.

Knowledge of the role which the *Salmonella choleraesuis* organism plays when associated with hog cholera, although far from complete, is quite extensive, but the information available on its association with other diseases and conditions is more limited. Two forms of the primary *Salmonella choleraesuis* infection are generally recognized—acute and chronic. It is the chronic form of the infection which has been specifically known as necrotic enteritis.

**Symptoms**

Necrotic enteritis generally begins with a rise in temperature, diminished appetite, and diarrhea. A number of factors may bring about variation in the intensity of these symptoms, and during the initial stage the trouble may frequently be diagnosed as hog cholera. If this diagnosis is followed by the administration of hog cholera virus and anti-hog-cholera serum together, the results may be disastrous. Sick pigs and many deaths may be expected. Post mortem examinations will probably reveal lesions, or tissue injuries, due to hog cholera, and the conclusion will be drawn that before the animals were treated the latter disease had progressed too far for
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the treatment to save them. This is one of the cases in which the services of a veterinarian are needed. Necrotic enteritis in its early stages may be similar to various other acute diseases besides hog cholera, and even with the most careful investigation it may be impossible to determine the exact nature of the trouble. Control measures will be determined by the definiteness and accuracy of the diagnosis.

After the first few days the temperature of pigs affected with necrotic enteritis may return to normal and their appetite improve, but the animals become unthrifty and fail to put on weight normally. Emaciation, weakness, prostration, and death often follow, particularly when no efforts at control are made.

Lesions

It is generally accepted that the lesions revealed by post mortem examination in cases of necrotic enteritis are confined chiefly to the gastrointestinal canal (the stomach and intestines) and are characteristic of the disease. However, many of the lymph glands, particularly those of the stomach and intestines, may be enlarged and reddened and may contain a larger amount of fluid than normal, which gives them a gelatinous appearance. The tonsils may show varying degrees of tissue destruction. The intensity of the involvement of the stomach also varies. In some cases the lining of the stomach is normal; in others the alterations may vary from slight or marked inflammation to extensive destruction of tissue. The small intestines may also fail to reveal any significant injury, but cases are observed in which the lesions vary from slight irritation to definite tissue destruction. The outstanding and most characteristic lesions of the disease are found in the large intestines, the walls of which are generally much thicker than normal. The lining shows the characteristic patches of dead tissue, varying in size from small circular spots to extensive areas involving several feet of the bowel. The entire lining can be easily scraped off. The dead tissue may slough and be mixed with the intestinal contents.

Variation in intensity of the symptoms and lesions is explained by a number of factors. (1) As in the case of many other disease-producing organisms, different strains of the Salmonella organism vary in their virulence or ability to produce disease. (2) Repeated passage through animals may increase the virulence of the organism. (3) The severity of the disease may vary with the number of the organisms taken into the animal's body and the frequency with which they are introduced. (4) Among individual animals and groups of animals there are variations in resistance to infection owing to numerous debilitating factors.

Control Measures

Various remedies have been used for necrotic enteritis, but reports indicate that as a whole they have been unsatisfactory. No known medicinal preparation has sufficient merit to be recommended as a specific treatment.
Experience has shown that it is more profitable to adopt adequate preventive measures than to attempt treatment after the disease has appeared in a herd. Rigid sanitation, as commonly recommended for the control of roundworms in pigs (see p. 774 of this volume), has proved to be quite effective in the prevention of necrotic enteritis. It is advisable to adhere to standard methods of swine production and to supply adequate rations so as to avoid the introduction of factors that might lower resistance to infection. When the disease has become established in a herd, separating the apparently healthy pigs from the sick ones and placing the former in clean quarters or on ground not previously used for swine often checks the spread of the infection.

**Relation of Nutrition to Necrotic Enteritis**

Much has been written recently on the relation of nutrition to necrotic enteritis in swine. Because of the interpretations given to certain nutritional investigations on rations deficient in pellagra-preventive (P-P) factors, many persons believe that necrotic enteritis is primarily due to a nutritional deficiency and that the addition of liver, yeast, and particularly nicotinic acid to the ration constitutes a cure and preventive. This view overlooks the importance of the *Salmonella choleraesuis* organism and may result in neglect of sanitation as a control measure. The evidence now available does not appear to be sufficient to justify reliance on adequate nutrition alone to control the disease.

On the basis of present knowledge, the situation may be summarized as follows:

1. Necrotic enteritis is a chronic form of *Salmonella choleraesuis* infection.
2. A vitamin deficiency, presumably of nicotinic acid, will produce in swine pellagra or a pellagralike disease, some aspects of which may be like necrotic enteritis.
3. Pigs affected with this vitamin deficiency may be subject to a more severe or extended attack of necrotic enteritis than pigs not so affected when similarly exposed.
4. When the rations are deficient, nicotinic acid and possibly other factors of the vitamin B complex should be given as a supplement for the prevention and treatment of the deficiency disease.

**Swine Dyentery**

Although swine dysentery has often been and sometimes still is described as a form of necrotic enteritis, it has become generally recognized as a specific disease. Because of its nature, it has been variously designated as infectious hemorrhagic enteritis, swine typhus, bloody diarrhea, bloody scours, bloody dysentery, bloody flux, black scours, and colitis (inflammation of the colon).

The disease has been reported in many sections of the country but it appears to be more prevalent in the large swine-producing States of the Midwest than elsewhere. Some idea of its extensiveness may be
gained from Hofferd’s report (3) that in a single year some veterinarians estimated death losses up to 1,500 head in their respective practices. The history of the majority of outbreaks generally discloses that the affected animals have been either directly or indirectly in contact with sales barns or public stockyards. Enforcement of sanitary regulations at these places has been reported to have been followed by a decrease in the incidence of the disease in swine from these sources.

**Symptoms**

Swine dysentery is considered to be an acute infectious disease and its outstanding symptom is usually a profuse bloody diarrhea. The fecal discharge often contains shreds of tissue in addition to varying amounts of blood. The disease starts in a few pigs and more pigs become infected each day. Some go off feed while others show no loss of appetite.

Biester, Schwarte, and McNutt (2) reproduced the disease experimentally in normal pigs by feeding them intestinal tissue and the contents of intestines from affected swine. The pigs showed a rise in temperature from the fourth to the seventh day. Diarrhea appeared about the sixth day and the elimination of blood a day or two later. On an average, temperatures in swine dysentery do not exceed 105°F and some do not show an appreciable variation from normal, or 104°F. (In many other acute infectious diseases, such as hog cholera, swine erysipelas, and *Salmonella choleraesuis* infection, the temperature commonly rises to 107°F or even higher.)

Some pigs die suddenly after a couple of days of illness while others linger for 2 weeks or even longer. Pigs that recover are stunted and usually unthrifty. Whiting (7) in 1924 reported that of 192 pigs exposed by feeding or pen contact, 167 developed the disease, while 25 did not show visible symptoms. All the pigs that did not develop the disease were later fed virulent material and remained healthy. Pigs that have recovered are not considered immune and are subject to repeated attacks. In a herd of young pigs 60 percent or more may die. The number of deaths in a herd of older pigs is usually considerably less. Both cholera-immune and cholera-susceptible pigs may be affected. The use of hog cholera virus and anti-hog-cholera serum for immunization of herds in which swine dysentery exists is generally followed by serious losses. Almost total loss of herds affected with swine dysentery has occurred when the disease has been accompanied by hog cholera.

While swine dysentery generally occurs where sanitation is poor and feeding practices questionable, it has been reported in herds kept under good sanitary conditions and fed rations generally recognized as satisfactory.

It has often been observed that the disease frequently occurs in hogs following cattle, including cattle that had been recently brought to the farm. Some observers think that this is merely coincidence, but others have suggested that cattle may be carriers of the disease. Hofferd (3) reports a herd in which the disease recurred whenever corn was added to the diet.
CAUSE AND LESIONS

The cause of swine dysentery has not yet been determined. A germ-free filtrate of intestinal tissues from affected pigs has failed to reproduce the disease when fed to healthy swine. A number of different organisms have been isolated from animals affected with the disease which, when fed to normal pigs, also failed to produce the disease.

Laboratory studies have revealed the presence of the organism *Salmonella choleraesuis* in some outbreaks, but in others it has not been found. This organism may not be instrumental in causing the disease, but since it is the cause of necrotic enteritis it seems probable that its presence in cases of swine dysentery may influence the course and final outcome of the dysentery outbreak. Outbreaks in which this organism is not present may respond to control measures differently from those where it is present.

The lesions found on post mortem examination in the early stages are principally in the large intestine. The lining of the cecum and colon is inflamed and bloody. In later stages, shreds and patches of dead tissue are found adhering to the intestinal wall or loose in the fecal contents. The stomach may also show lesions, but the small intestine is not usually involved. When secondary complications set in, lesions in other parts of the body may be found. These vary with the nature of the complicating factors.

CONTROL MEASURES

Much effort has been given to control of swine dysentery, and many remedial measures have been used. Each has its advocates, and some may be beneficial in lessening the severity of the disease. None has sufficient merit, however, to be recommended as a specific treatment.

A review of the control methods used indicates that preventive measures give the best results. No means of vaccination or immunization is known. Until more is known about the disease it is necessary to rely on sanitation as a means of prevention. Since the exact nature and sources of the causative factor are unknown, sanitary measures must be very broad and must take in all the probable sources of infection. For instance, since cattle or brood sows may be carriers, preventive measures must include them.

Certain procedures may be practical on one farm and others on another. The advice of a veterinarian should be obtained in formulating an adequate and effective scheme of sanitation. Since affected pigs are obviously a common source of infection, extreme caution should be used when swine from the outside are brought to a farm where there is a herd of healthy pigs. The new group should be isolated and quarantined where they may be observed for at least a week, preferably longer, before being added to the healthy group.

If swine dysentary has become established in a herd, the apparently healthy pigs should be separated from the sick ones. When any of
the healthy group sicken, they should be removed. On the basis that it is worth while to limit the amount of infected material the pigs can get, some recommend the removal of both groups, sick and healthy, to concrete floors that can be kept thoroughly clean. Others would remove both groups to clean ground. Observations indicate the importance of removing the pigs from the contaminated lots in which they have been running. The contaminated quarters should be cleaned and disinfected before being restocked. It is desirable to wait until the end of the summer before placing pigs in the lots where infection occurred. Good drainage and clean water should be provided. Pigs that have recovered should be sold for slaughter rather than allowed to remain as a possible source of infection for a new group. At all times attention should be given to standard methods of feeding and proper nutrition.

Sanitary officials have given continuous attention to the formulation and enforcement of regulations to minimize the spread of the disease as a result of the transportation of swine through public stockyards and public sales stables.

When the cause of the disease has been determined, modification of the sanitary measures now employed to control it may be warranted.

**ENTERITIS AND SCOURS IN BABY PIGS**

The annual loss of young pigs in the United States is very large. On many farms it is not unusual for 50 percent or more of the pigs to die during the first few days of life. Reports indicate that most of these have developed enteritis and scours. The trouble has been attributed almost entirely to faulty nutrition and lack of proper housing, care, and sanitation.

The condition is usually recognized by its common symptom, diarrhea. The ailment soon spreads to all the pigs in the litter, particularly when the pens are not cleaned and disinfected. The pigs may scour for a few days, stop suckling, and die or become unthrifty.

While it is a common practice to treat the sick pigs by giving some medicinal preparation, such as castor oil or formalin, this procedure offers little chance of success unless primary attention is given to providing clean quarters, proper care and feeding of the mother, and general sanitation. (See p. 774 of this Yearbook and Farmers' Bulletin 1437, Swine Production.)

An enteritis in baby pigs which has some characteristics not common to the so-called scours has been reported. It has been called the little-pig disease or the 3-day-pig disease. The pigs show symptoms of weakness, unsteady gait, emaciation, roughness of hair, and sometimes a wrinkled appearance of the skin, and most of them are droopy and listless. The number of such pigs that have diarrhea varies.

Post mortem examination reveals a varying degree of enteritis confined largely to the small intestine. The stomach is normal and generally contains curd, which indicates that at birth the pigs were in condition to nurse.
This condition occurs in litters from sows that are fed garbage as well as from sows that are on other rations considered satisfactory. Pigs are usually affected 24 to 72 hours after birth and generally die within 24 to 36 hours after the first symptoms appear. Experimental work so far has failed to reveal the cause. Recent investigations have shown that the blood of affected pigs contains much less blood sugar than that of normal pigs. If the amount of blood sugar was not too low, recoveries often followed injections of glucose solution and forced feeding of milk.

ENTERITIS DUE TO MISCELLANEOUS CAUSES

Inflammation of the intestines is frequently associated with many diseases and ailments caused by protozoa, parasites, bacteria, and viruses, including swine erysipelas, anthrax, and hog cholera. In chronic hog cholera, areas of dead tissue commonly referred to as button ulcers may be observed in the intestines. Various mineral poisons such as lye and copper sulfate also cause enteritis in swine. The control and treatment of these types of enteritis naturally depend on the cause.

LITERATURE CITED


