Swine Erysipelas

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IT WAS ONLY 20 years ago that swine erysipelas was first definitely recognized in this country. Ten years ago it was found to be an acute herd infection in certain areas. Will it become as serious a disease here as it has been in certain parts of Europe? The developments outlined in this article will be watched with interest by producers.

Swine erysipelas has for many years been one of the most important diseases of swine in continental Europe and in England. The causative agent was discovered by Pasteur and Thuillier in 1882 and 1883. Loeffler, working at about the same time, studied the organism but did not publish his observations until 1886. It is of interest to note that in 1879 Koch discovered the mouse septicemia bacillus (Bacillus murisepticus), which is considered to be identical with the swine erysipelas bacillus.

In the United States, the specific organism of swine erysipelas, technically named Erysipelothrix rhusiopathiae, was first isolated in 1921 by Creech, of the Bureau of Animal Industry, from a lesion, or tissue injury, in a hog that came from Texas. The organism was obtained from a specimen of skin showing a typical "diamond skin" lesion. Such lesions, typical of those described in European countries as the result of an infection with swine erysipelas, had been observed in the United States for many years, but the disease was called diamond-skin disease. Swine erysipelas was not considered to be present in this country before the discovery of the organism by Creech. After Creech's discovery other workers isolated the organism from lesions in

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the joints and some other parts of the bodies of swine. It was then recognized definitely that swine erysipelas existed, apparently in a chronic form, in certain parts of the United States.

Beginning in 1930 the disease was recognized as an acute herd infection in South Dakota, Nebraska, and other States of the Corn Belt, and since that time it has continued to be a more or less serious disease of swine in certain areas in those States.

**NATURE AND CAUSE OF THE DISEASE**

Swine erysipelas is an insidious disease, and the manner in which it spreads is not entirely understood. It is quite likely, however, that the disease requires considerable time to make any appreciable headway in certain areas or in a new territory. In certain parts of the United States it has probably existed in a chronic form for many years, gradually increasing in virulence in certain areas until, when favorable conditions prevailed, it manifested itself in the explosive, or acute, type.

Breed, reporting on the distribution of swine erysipelas in the United States, stated that the organism had been identified as a cause of swine maladies in 28 of 46 States; from two States no reports were received. While the infection appears to be confined principally to the Corn Belt, it perhaps exists in many other States in a chronic, low-grade form.

That the disease flourishes under certain conditions is apparent from the European literature and from observations made in this country. The disease occurs most often during the spring, summer, and fall, but it has been observed in the United States in every month and every season. An explanation for this is that in this country sows farrow every month of the year, and thus there is a continuous supply of new pigs susceptible to the infection.

Swine of all ages are susceptible to the disease, from suckling pigs to adult animals. The causative organism has also been found to affect a variety of birds and animals, including man. Horses, cattle, sheep, dogs, ducks, chickens, turkeys, mud hens, and parrots have been reported to be susceptible. In certain parts of this country, the disease has been of economic importance in sheep and turkeys. That the organism is quite infective to man is evidenced by the number of cases reported in the literature. Veterinarians, butchers, and livestock handlers have frequently been infected. Infection among laboratory workers is not uncommon, while numerous cases have been recorded among workers in bone factories. The so-called fish handlers' disease has been found to be caused by infection with the swine-erysipelas organism, which has been found on the skin of many salt-water fish.

Although it does not bear spores, the erysipelas organism is very resistant to adverse conditions, owing, it is claimed, to a waxy substance it contains. A culture of the organism that was experimentally dried on a glass surface and kept at 98°F remained alive for a month. In a cool, dark place also it remained active for a month. In smears

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on glass exposed to direct sunlight, the organism survived only 2 days. Under laboratory conditions in various types of media, it has a very long life. Nocard and Leclainche\(^6\) state that organisms remain alive for 17 days in water. The organism is very sensitive to heat, however. At 111° F. it is destroyed in 4 days, at 125° F. in 15 minutes, and at 130° to 137° F.—far below ordinary cooking temperatures—in several minutes.

Living erysipelas organisms have been found in putrid material after 4 months. In the flesh of swine, the organisms are quite resistant to destruction, and Preisz\(^7\) reports living organisms in a carcass that had been buried for 280 days. The organisms are only slowly destroyed by salting and pickling, and they also have been found alive after 26 days in strong brine. Salting hams with salt and saltpeter failed to destroy their virulence in 30 days. Organisms added to pickling fluid were still virulent after 170 days. On the other hand, the organism is not resistant to the action of disinfectants. It is killed by solutions of phenol in 15 minutes, while formalin and ordinary lye readily destroy it.

In areas where the disease is found, the organism exists in the soil as a saprophyte, living on dead or decaying organic matter. Evidence has been presented to show that it can multiply in the soil under certain conditions and that sandy soils rich in lime and humus are especially favorable.

These facts are evidently important in outbreaks of the disease. Since the organism can survive for long periods in certain soils, the recurrence of swine erysipelas can readily be brought about by favorable conditions. It appears that on some farms where infection exists the disease may recur irregularly over a period of several years, though this may not happen on other farms where the soil is similarly infected. No satisfactory explanation has been made for these differences. Once an infection has appeared on a farm, however, a potential danger exists that it will reappear in subsequent years.

It is not definitely known whether infection proceeds directly from animal to animal or whether the organisms excreted by an infected animal must pass some part of their life outside the animal body or otherwise undergo some change before they are capable of reproducing the disease. It is generally agreed that cultures of the organism can reproduce the disease only with the greatest difficulty when injected into swine. It is also generally held that some unknown factor in addition to the organism itself is necessary to bring about infection. The experience of Bureau of Animal Industry pathologists supports this idea. Several years ago, for example, two healthy hogs were placed in contact with two hogs affected with a chronic form of swine erysipelas. The four animals were housed in a small enclosure on a concrete floor. After almost 3 months the normal animals remained healthy. Soil was then placed on the concrete floor. About 2½ months later both the normal hogs developed the disease and died within a week of each other. *Erysipelothrix rhusiopathiae* was recovered from the organs of the dead animals.

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\(^7\) See reference in footnote 2, p. 686.
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During an acute attack of the disease, the causative agent can be found in the blood, urine, and feces, and the surroundings of the animals soon become heavily contaminated. Animals affected with the chronic form of the disease may also pass it on to others.

It has been shown that the swine erysipelas organism may be harbored in some parts of the bodies of apparently healthy animals, such as the tonsils and parts of the intestinal tract. Possibly this is a result of a previous infection and recovery, or the organisms may have been picked up from contaminated soil without infection resulting. Such animals may possibly be dangerous to others, or they may subsequently develop the disease themselves.

SYMPTOMS

Acute swine erysipelas is characterized by its sudden onset, and many swine in the herd may be affected at the same time. Only a few may be visibly sick, while a number of others may run high temperatures—105°-110° F. Affected hogs lie in their bedding, but it may be noted that their eyes are clear and active—every move an attendant makes is watched, but they are very reluctant to move themselves. If forcibly disturbed, they start off with considerable activity but protest with loud squeals. Since the tissues of the joints are involved in the disease process, many of the affected swine are undoubtedly in pain when they walk. They make an effort to keep their feet under them, which makes the backbone appear long and strongly arched. After moving about a bit, they drop down on their bedding again. Where considerable swelling at a joint is noted, there may be exostoses (bony growths), which do not disappear when the disease subsides. Animals thus affected are the so-called knotty-legged hogs, or chronics, which harbor the disease organisms in their joints and may act as spreaders of the infection.

Several of the hogs may die quite suddenly. They may appear well at feeding time one evening and be found dead the next morning. There have been cases where entire herds have died, but this is rather rare at present in this country, although it is not so uncommon in unvaccinated herds in swine erysipelas districts of Europe. As a rule only a few hogs die, some make a complete recovery, and the rest may remain unthrifty chronics.

In hogs acutely ill with swine erysipelas, shortness of breath caused by pulmonary edema—a waterlogged condition of the lungs—may be noted. At times swellings about the snout make breathing very difficult. Nausea and vomiting are not uncommon symptoms. Some 24 to 48 hours after the onset of the disease irregular red patches, which are neither tender to the touch nor swollen, may be noted on the lighter parts of the skin. Such areas may remain localized or may enlarge and run together until the greater part of the body surface is involved. Death is sudden, usually preceded by respiratory distress (labored breathing) brought about by pulmonary edema and heart weakness. The temperature drops, and the mucous membranes become cyanotic (blue).

The so-called diamond skin, skin with regular rhomboidal lesions
(fig. 1), sometimes appears in acute cases in which the affected swine die within 3 days after the onset of the disease. Such lesions on the skin are, however, usually associated with a less severe type of swine erysipelas, in which the symptoms are of a milder character and rapidly subside after the appearance of the characteristic skin eruption. Unless complications set in, hogs affected with the mild type

**Figure 1.**—Rhomboidal, or diamond-shaped, skin lesions of swine erysipelas. This specimen of skin was taken from a hog which was inoculated on October 11 and died on October 14.
of erysipelas usually recover within 2 weeks. Where the diamond-skin lesions extend over considerable areas, however, there may be a dry gangrenous sloughing of large portions of skin. The ears and tail are often lost in this way. Loss of the tail, which is the more frequent; may be the only apparent evidence of infection, past or present. Skin lesions are difficult to see except on the lighter colored breeds of hogs or on the light parts of dark breeds.

The swine that do not die of the disease are often left in such a condition that they are unprofitable to the owner. Many have swollen joints, and these animals are discounted by the packer-buyers. Others that do not have enlarged joints may appear dehydrated (dried up), and these are called race-horse pigs by some owners. Such hogs eat a great deal but do not fatten as soon or as well as normal hogs. Joint trouble may appear as an independent manifestation of the disease. All the joints may be enlarged, but those of the knee, hock, and toes are most frequently affected.

At times the only indication of infection in a herd is a dry, scaly eczema (skin eruption), which is nonparasitic in character and fails to clear up in response to changes of feed or the use of dips and oils. Such lesions disappear as a rule upon the administration of specific antiserum, alone or in combination with living culture, as described later.

**DIAGNOSIS**

The diagnosis of swine erysipelas presents many difficulties, but in areas where it has become prevalent veterinarians, through clinical observations supported by laboratory findings, have been able to recognize it with a fair degree of accuracy. The disease is at times confusing, however, because it may manifest itself in so many ways. The problem is one for the consideration of a veterinarian.

Symptoms and manifestations that aid in diagnosis are the sudden onset, typical skin discolorations, dehydration (dried-up appearance) of the skin, curled ears, stub tails, evidence of pain on moving, reluctance to move unless forcibly aroused, enlarged joints, scaly eczema, swellings on ears, snout, legs, and elsewhere, sloughed ears and sloughing of patches of skin, and high temperature. The eyes may be clear and the squeal vigorous.

Specimens from suspected outbreaks of swine erysipelas should be forwarded to a diagnostic laboratory for bacteriological examination. Such laboratories are maintained by many of the States to aid in diagnosing and controlling diseases and ailments of livestock and poultry.

Since the definite diagnosis of swine erysipelas is very difficult from a clinical standpoint, attention has been given in recent years to the development of serological methods of diagnosis. These depend on the reaction of whole blood or blood serum in a laboratory test. The Bureau of Animal Industry started working on this problem in 1932 and, after considerable experimentation both in the laboratory and in the field, has developed the rapid-plate agglutination test, which, within limits, has proved a valuable aid in diagnosis.

In using the test it is quite important to recognize its limitations.
and interpret the results properly. Definitely positive reaction in swine indicates either infection with or exposure to the specific microorganism. Swine that have recently received injections of the specific antiserum also give positive results as early as 24 hours after the administration of the test, and this reaction may persist for some weeks. The test has little value, therefore, in the case of animals that recently received the specific antiserum.

Positive reactions may possibly be obtained in animals that show no clinical evidence of the disease, which may be explained by the fact that swine erysipelas organisms may be harbored in the body of an animal without producing any visible lesions or symptoms. It is also possible that there may be obscure joint lesions that are the result of erysipelas infection. Experimental work has shown that on a very thorough post mortem examination, most of the apparently normal hogs kept on premises known to be infected and showing a positive reaction to the test will exhibit lesions in one or more joints. By bacteriological examination of a number of these animals it has been possible in most instances to isolate the swine erysipelas organism. Bureau pathologists have found that animals showing visible joint lesions on clinical examination give a strongly positive reaction to the test and that the organisms is easily recovered from such animals. Animals that react less strongly may simply be harboring it.

Generally speaking, the test is considered to be more applicable to herd diagnosis than to the diagnosis of the disease in individual animals, and for the present its use should be restricted to persons qualified to make proper interpretations. When erysipelas is suspected in a herd, a number of animals should be tested and the diagnosis should not be made until the representative serological picture of the herd can be obtained. The fact should be kept in mind that the chronic form of swine erysipelas may be present in a herd that is also affected with some other acute disease, and a positive reaction does not necessarily shut out the possibility of some other infection also being present.

**CONTROL MEASURES**

Since swine erysipelas is propagated in the infected animal and apparently also in the soil, when it appears on a farm to determine the best procedure to follow is a difficult problem. As has been previously stated, the organism may live in the soil for a considerable period, although it can be destroyed in hogpens by the usual cleaning and disinfection.

Since the disease often manifests itself in a low-grade type of infection and since it has been shown that animals affected with this chronic form may under certain circumstances pass it on to normal hogs, it is apparent that such animals should be removed from the herd.

Anti-swine-erysipelas serum has been available for some years, but, while effective, it has certain limitations. The immunity produced by the injection of serum cannot be expected to last more than 2 or 3 weeks. Likewise the serum is effective only when given very early in
the acute stage of the disease. After the disease once establishes itself and becomes chronic, the value of the serum is very limited.

In European countries use is made of an active-immunization procedure, which includes administration of both a live culture of the causative agent and hyperimmune serum—the so-called simultaneous method of immunization. This method has not been considered to be applicable for general use in this country because the live culture might set up new centers of infection in cases of mistaken diagnosis of swine erysipelas. In certain sections of the Corn Belt, however, the disease has progressed to such an extent that a large-scale experiment in which the simultaneous method of vaccination is used under restricted conditions is now being conducted cooperatively by several of the State livestock sanitary authorities, the State experiment stations, and the Federal Bureau of Animal Industry. Certain herds are vaccinated with the serum and culture, and accurate records are kept of the results. The plan is to run this project for several years before a final decision is reached as to the applicability of the serum-and-culture method of vaccination in the United States. The results so far have been very satisfactory, but sufficient time has not yet elapsed to get full information.

In handling diseases of swine, owners should always get in contact with State and local veterinarians, and this is particularly important in combating actual or suspected outbreaks of swine erysipelas.

RELATION TO ARTHRITIS

Considerable experimental work and field observations over a period of years have shown that the swine erysipelas organism has a marked predilection for the joints, even in the early stages of the disease while it is still acute. Arthritis may result from an acute attack of swine erysipelas or from a low-grade infection in which the animal may not be noticeably sick at any time but may later have enlarged joints.

The term "arthritis" designates an inflammation of the joint, whether or not the joint is enlarged. Post mortem examination of a large number of hogs has revealed that those affected with the arthritic form of swine erysipelas may show extensive damage to one or more joints, including the articular surfaces and the joint capsules, with no visible enlargement.

It was demonstrated by Ward as early as 1922 that cases of arthritis in swine were caused by infection with the swine erysipelas organism. Since swine arthritis has become widespread in recent years, it was thought advisable to seek additional information which would give some idea as to the distribution of the disease in various parts of the country. Accordingly, beginning in 1939, specimens of arthritic lesions in swine were obtained from a number of meat-inspection centers in various parts of the country with information as to the origin of the hogs from which the specimens were obtained. Up to the date of writing a total of 572 joints had been received and examined bacteriologically. The swine erysipelas organism was recovered from

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444 of these, or 77.62 percent, and it is probable that the percentage would have been higher had it been practical to make extensive cultural tests of all the affected joints. The swine from which these specimens were obtained (swine with erysipelas) had their origin in 114 counties in 16 States (Iowa, Nebraska, Minnesota, South Dakota, Texas, Oklahoma, Arkansas, Tennessee, Mississippi, Alabama, Florida, Virginia, Maryland, Pennsylvania, Kansas, and Missouri); but the greatest number came from the Corn Belt.

**DIFFERENTIAL DIAGNOSIS**

The principal disease with which swine erysipelas might be confused is hog cholera. In acute swine erysipelas the onset of the attack is as a rule more sudden and abrupt and its course more rapid than in hog cholera, and body temperatures are generally higher. In swine erysipelas the animal gives more evidence of pain on being handled than in hog cholera. In swine affected with erysipelas the eyes remain clear and active, while in those with cholera they become dull and gummy.

There may sometimes be confusion in the picture presented by a post mortem examination, but usually in hog cholera the lymph nodes assume a dark-red or marbled discoloration, while in swine erysipelas there may be little change in color but marked evidence of edema, though at times a cherry-red to violet discoloration may be noted.

In uncomplicated hog cholera the spleen remains normal in size; in swine erysipelas it usually shows some enlargement. In hog cholera accompanied by certain bacterial infections, however, enlargement of the spleen may be noted.

In hog cholera intestinal lesions are more commonly found in the large intestine. In swine erysipelas they are more commonly observed in the small intestine.