

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
BULLETIN 174

HOG CHOLERA AND IM- MATURE CORN

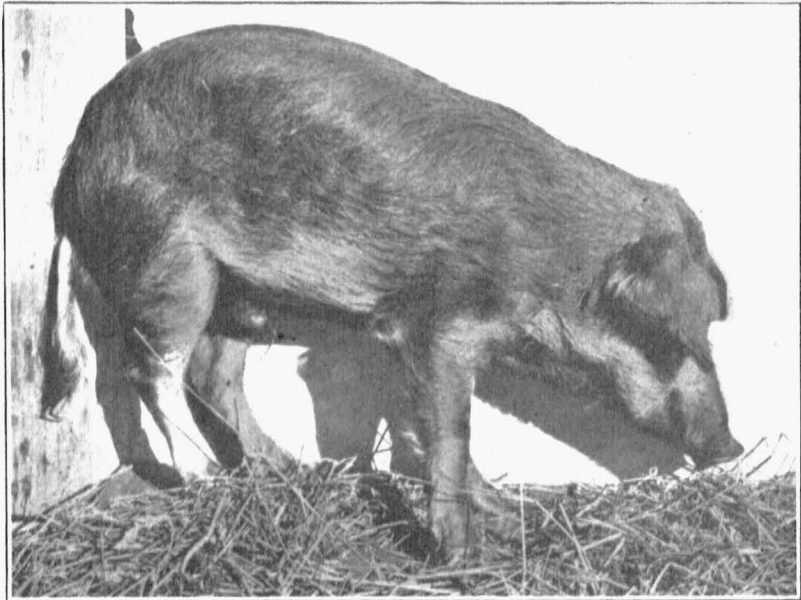


FIG. 1.—Pig affected with hog cholera

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Hog Cholera. and Immature Corn

J. W. CONNAWAY, D. V. S., M. D.

INTRODUCTION

The purpose of this bulletin is to impress upon the minds of the swine feeders a fact generally recognized by veterinarians that losses from disease in the feed lot is due primarily to hog cholera; and that the popular notion that immature corn may originate this disease is a fallacy.

It is also sought to show what is properly the true relation of the secondary infections to hog cholera, that these secondary bacterial invaders are relatively of minor importance as disease-producing factors, and that the effective control of hog cholera will render them practically harmless.

The sources of cholera infection to feeding hogs are stated as well as the precautions to be observed when recently vaccinated hogs are put on the new corn ration. An attempt is also made to give the swine raiser a clearer idea of how immunity against hog cholera is acquired, and to show that a relapse or "break" from "vaccination cholera" is liable to occur from neglect on his part and especially that attempts to hasten the fattening process by excessive feeding at the beginning of the feeding period is injudicious.

A matter of no less importance is presented in the latter part of the bulletin under the head of "Diagnostic Points," since the diagnosis of hog cholera has been confusing to many swine raisers who are unable to obtain the services of a veterinarian. The illustrations and descriptions of the cholera lesions, and of the complications arising from secondary bacterial invaders, will aid materially in making a correct diagnosis of cholera cases, and will lead to a more prompt and efficient treatment of cholera infected herds.

SOURCES OF INFECTION

Past experience has shown that, with the increased traffic in hogs for feeding purposes, during the fall feeding season hog cholera outbreaks are liable to occur. These outbreaks are often ascribed to the feeding of new corn; but hog cholera nor any other specific infectious disease is caused by new corn. The virus or germs of hog cholera are always necessary to cause an outbreak of that disease. The *injudicious feeding of new corn* is, however, a factor which may increase the losses from cholera when the germs of that disease are present.

Most of the herds that become sick after feeding for awhile on new corn are already infected with the disease germs prior to the beginning of the feeding period, or become infected from some other source than the corn after they are put on to this feed. Many of the feeding hogs are shipped in from some other locality and are often mixed bunches, picked up from various farms, some of which are liable to harbor cholera infection. Some of these feeding herds pass thru stock yards which are permanently infected with cholera germs; or they may be shipped in infected cars. Hogs thus exposed if not immune will contract the disease, and a large per cent will die after they arrive at the feeding farms. Moreover, "breaks" from cholera will occasionally occur in car-lot shipments which have been given the "double treatment" for permanent immunity, if the feeder does not exercise proper care at the beginning of the feeding period. The turning of a car-lot of feeding hogs direct-

ly into the corn fields on arrival from the stock yards is attended with considerable risk, because the fatigue and the disturbance of the circulatory and digestive functions incident to vaccination and the stress of handling and shipping lower the vitality and powers of resistance of the hogs. Under these conditions it is injudicious to permit the hungry hogs to overload the stomach; and especially with new, immature corn, which is more fermentable than fully ripened and well-cured grain, and more liable to cause digestive disturbances and diarrhea. This disturbance of the digestive functions from dietetic errors will still further increase the susceptibility of the herd to hog cholera, and its complications, even tho new or soft corn is not a direct cause of cholera. The importance, therefore, of having the "feeder" hogs well immunized against hog cholera this fall before feeding the new corn crop can scarcely be over-emphasized, because of the probability that a considerable amount of the crop, and especially the last plantings, will not be properly matured and hardened before the feeding season begins. Besides, a considerable portion of the soft corn must be utilized by feeding it to hogs.

There is an impression among some feeders that "double treated" hogs can be put with safety on full feed almost immediately after vaccination; and it is true that in many cases no bad results have occurred, but the risks are too great to recommend such a practice. A gain in the total time of feeding, in the final weight, cost of fattening, and ultimate profits, can be made by proceeding slowly at the beginning of the feeding period. This will usually prevent the setbacks due to "cholera breaks," and associated complications such as pneumonia and necrotic enteritis which sometimes occur when hogs are put on new corn.

DURABLE IMMUNITY ACQUIRED SLOWLY

A longer period is required to develop a permanent immunity in vaccinated hogs than is commonly supposed. The most potent anti-hog-cholera serum that can be made cannot of itself confer a *permanent* immunity. Serum alone confers an immunity of a passive or temporary character, the duration being variable. The use of the "serum alone" is, therefore, applicable only to short feeding periods unless the herd is re-vaccinated or a thoro disinfection of the premises is made. When, therefore, a herd is in constant danger of exposure to hog cholera infection, it is preferable to confer a permanent immunity; but this cannot be secured except by subjecting the animal to the disease-producing activities of the virus. It is well known that the hog which recovers from a natural attack of hog cholera becomes, as a rule, permanently immune. Likewise, that the "double treated" or "serum-virus" inoculated hog gains a permanent immunity, if the virus is a living and vigorously active virus. The virus, however, in the vaccinated hog as well as in a natural attack of cholera acts in a harmful way on the cells of the body; and the cells, for self-protection, must react to the attacks of the virus and produce specific "anti-bodies," or protective substances, to counteract the harmful action of the virus. A veritable combat ensues when hog cholera infection enters the system of a hog, and this combat terminates either in the death of the hog or in an immunity more or less permanent. The *vaccinated* hog, however, has this advantage over the hog which has become infected with virus from natural exposure—a liberal dose of potent anti-hog-cholera serum is injected simultaneously with

the virus, and this constitutes a supply of "reserve ammunition" which the vaccinated hog draws upon for protection while it is strengthening its cellular defenses and elaborating its own protective serum. If, however, the vaccinated herd is not properly handled and properly fed; the virus may overcome the protective guards in spite of the reserve ammunition with which the body was reinforced; and some of the hogs may succumb to acute cholera of the septicemic type; or may linger along, with a chronic type of the disease, and finally die, from the pneumonic complications or from chronic inflammation of the intestines.

ACTIVITY OF VIRUS IN VACCINATED SWINE

Experiments which have been made at the Missouri Agricultural Experiment Station show that the virus remains *alive* and *virulent* in the "double treated" hogs for a considerable time after vaccination, even in vaccinated hogs which are given good care and do not show outwardly any symptoms of illness. It was found that (for a period of more than a week) blood which was drawn daily from the tails of "double treated" hogs was almost as virulent as blood drawn from a pig showing well-marked symptoms of cholera; moreover, the blood drawn from some of the double-treated hogs even as long as twenty-three days after vaccination was still sufficiently virulent to cause death when inoculated into a healthy susceptible pig.

It is thus shown that the process of acquiring immunity and overcoming the disease germs in the body is evidently a slow process, and proper care should be given the vaccinated herd for three weeks or more to avoid the development of acute or chronic cases of cholera from the vaccination. Rough handling during this period, overfeeding after a fatiguing railroad haul or a long drive, may so lower the resistance of some of the animals as to permit the cholera virus with which they have been vaccinated to gain the upper hand and cause death from a true attack of cholera.

"CHOLERA BREAKS" AFTER VACCINATION

A genuine relapse from cholera has occurred more frequently than has been suspected in car-lots of swine which have been treated by the serum-virus method, and held for a period of 21 days or less before shipment. Other causes than cholera have often been assigned for these cholera breaks in vaccinated hogs, because of the common impression that hogs are solidly immune within a short period after administration of the serum-virus treatment.

To illustrate the point that relapses may occur in swine after release from quarantine of two or three weeks following vaccination (unless handled in a proper manner), one case which was investigated quite thoroly will be mentioned. This herd was purchased as an *immune* herd, and the buyer was particular not to accept the animals until they had passed the full 21 days in quarantine. There is good reason to believe that the vaccination was done in a proper manner and with serum of full potency, because the work was done under federal supervision. But unfortunately the hogs were loaded out on a very warm day, and the car was a little crowded; moreover, the train was delayed in reaching its destination, and the hogs were on the car nearly 24 hours before unloading. They were then driven several miles to the farm of

the owner. Some of the hogs showed considerable fatigue during and after the drive. The hogs were put at once onto a green corn ration. Within a week some of the hogs showed well-marked signs of illness, and in ten days several had died. An investigation of the case showed the ailment to be hog cholera. The owner could scarcely believe that the hogs were affected with this disease, as he had purchased what he believed to be a well immunized carload. However, the symptoms, the post mortem examination, and the successful production of cholera in other hogs by inoculation and feeding experiments with materials from this herd, as well as by exposure experiments, proved the outbreak to be hog cholera. It thus appears that the unfavorable conditions mentioned combined to lower the resistance of the swine; and the cholera germs, which were still alive and virulent, multiplied actively in the less vigorous and less resistant animals, overcoming the protective power of the serum which had been injected and the protective "anti-bodies" which had been developed by the vaccination.

If the fact is kept in mind that such relapses or "breaks" following vaccination can and do occur in herds subjected to unfavorable conditions, there will be less tendency to blame veterinarians for poor results in vaccinating, or to blame the serum for lack of potency.

PRECAUTIONS AGAINST CHOLERA BREAKS

Good serum and active virus in sufficient quantity, and properly administered, are essential to conferring an active or permanent immunity; but disastrous results may occur if the feeders do not give proper after-care to the vaccinated feeding herds, for hog cholera virus has the power under certain conditions to cause a fatal illness, as well as the power under more favorable conditions to stimulate the development of a permanent immunity. Vaccinated herds should, therefore, be handled and fed during the immunizing period with greater care than is necessary at other times. And, if circumstances should require the feeding of new corn before the vaccinated hogs have acquired a solid immunity, a smaller quantity of this food should be given than ordinarily until the hogs are well accustomed to the change. A larger share of old corn if available should at first be given, and the new corn gradually increased in amount. An exclusive ration of corn, either old or new, is not the most nutritious diet nor usually the most economical one. It should be supplemented by a partial ration of muscle-building or protein-bearing foods and those containing bone-making elements and the vitamins. Such foodstuffs as bran, shipstuff, linseed or cottonseed meal, tankage, bonemeal, crushed oats and wheat screenings all supply important body constituents and all are available upon the markets. At the beginning of the feeding period, if the new corn crop is to be hogged down, a feed of old corn and supplements as a morning ration before turning into the fields is suggested as a method of preventing digestive disturbances from an overfeed of the more fermentable new corn. Access for a part of the day to a clover, alfalfa or bluegrass pasture is advised, if such pastures are available.

The foregoing precautions will prevent most of the breaks or relapses that occur within two, three or four weeks following vaccination. Such precautions perhaps would be less needful if the owner and the veterinarian were certain that all the hogs in the herd were in a thrifty, vigorous condition at

time of vaccination; and especially if a liberal dose of serum is administered. But it is not always easy to judge from outward appearances the actual condition of health and powers of resistance of a hundred or more hogs at the time of vaccination. In some instances a considerable number of the hogs may be badly infested with worms but this fact may not be manifest nor discovered until a pig or two has died from vaccination cholera, and the post-mortem examination has revealed the conditions.

The rule of experienced veterinarians is to increase the dose of serum when vaccinating hogs which from any cause are unthrifty; and this is a good rule. But serum is not a vermifuge; moreover, the dose which is given may fail to hold the cholera virus in check in the hog that is badly infested with worms. But whatever may be the cause of the development of active symptoms of cholera in vaccinated hogs, a prompt revaccination of the herd to reinforce the natural defenses against the cholera virus is advisable, while applying proper measures to eliminate the worms or other unfavorable conditions.

WHAT TO DO WHEN VACCINATION BREAKS OCCUR

The prudent course for the swine feeders to pursue when several hogs of the feeding herd become sick within the first two to four weeks following vaccination is to suspect a "break" from cholera, and to call the veterinarian who did the vaccinating and have him make a thoro examination of the sick animals, study the symptoms, take temperatures, look into the conditions of care and feeding, and make a careful post-mortem examination of any hogs that may die. If one or more hogs appear to be fatally ill these should be killed and the viscera examined. If the disease conditions which are found are like those occurring in cases of hog cholera in untreated herds, the herd should be revaccinated. The tendency to delay revaccination unduly and to seek for some other disease than hog cholera to account for the illness, simply because the herd was vaccinated a few weeks previously, is liable to result in considerable loss which might be avoided by prompt revaccination.

The prompt correction of errors in feeding and in the general care of the herd are essential, and may in some cases be sufficient to restore the herd to a healthy condition. Restriction of the ration is always good treatment no matter what the disease, and this is particularly true of hog cholera, whether from natural infection or following vaccination.

In these cases of cholera breaks after vaccination the mistake has frequently been made of vaccinating against the *secondary infections*, which are sometimes complications of cholera, instead of revaccinating against cholera itself. The great anchor of safety for the swine industry so far as vaccination against epizootic swine disease is concerned is the anti-hog-cholera serum. The opinion of many veterinarians is that the "bacterins" or other vaccines used in swine practice are of questionable value. The fact cannot be impressed upon the mind of the swine raisers too strongly that hog cholera, so far as has yet been demonstrated, is the only epizootic disease of swine in this country which is capable of spreading from herd to herd and causing large losses; and if greater effort were given by the swine raisers and veterinarians to the control and eradication of this disease, and to the application of proper sanitary measures in the handling of the swine herds, there would be little

need to bother about the minor secondary infections which are associated with that disease, as these would give but little trouble.

SECONDARY INFECTIONS—"HEMORRHAGIC SEPTICEMIA," ETC.

This brings us to the consideration of the secondary infections which complicate the hog-cholera problem. Much has been heard during the past few years concerning "swine plague" or "hemorrhagic septicemia" of swine, as it is now known. The terms "mixed infection" and "necrotic enteritis" have also become familiar to many swine raisers; and even "hog flu" is a coinage of the last two years, which has served no good purpose so far as the needs of the swine raisers are concerned.

The symptoms and the "lesions" or disease conditions occurring in the various organs of the sick hog, which have given rise to the foregoing names, are merely symptoms and conditions which are produced by hog cholera and by associated secondary bacteria, which under ordinary conditions are quite harmless. The so-called swine-plague or hemorrhagic-septicemia microbe, for instance, is a common hog-yard germ. It occurs in the dust and the soil of the feeding pens and does no harm to a healthy, vigorous hog. These germs are taken into the stomach daily and traverse the digestive tract without harm to the hogs. They are drawn into the nostrils in breathing, and can be found in the upper air passages of healthy swine, where they do not cause any serious inflammation, and are then carried out again with the mucous secretions. The presence of such bacteria on the healthy mucous membrane has been demonstrated by careful laboratory workers; and it has been shown that these bacteria conform in shape, size and all the laboratory tests for identification, with the so-called hemorrhagic septicemia germs which are sometimes found in the diseased tissues of swine. And the conviction has come to a number of the veterinary investigators that this microbe is merely a secondary or accidental invader of the diseased organs and is not the primary causative agent of any epizootic swine disease. Also, that if it does produce harmful results they occur as a rule only in association with, or secondary to, some other and more virulent micro-organism such as the highly virulent infection of hog cholera.

SANITATION AND GOOD CARE PREVENT SECONDARY INFECTIONS

It is quite possible that these usually harmless bacteria may invade the blood and cause septicemic troubles and pneumonia in hogs which are exposed to extremely insanitary conditions. Hogs which are not properly protected from the winter storms but are allowed to bed around straw stacks and upon manure piles, piling in heaps, are especially liable to contract "colds" and pneumonia; and in swine which are ill from such conditions it will not be difficult to find the so-called "hemorrhagic septicemia" bacterium and other bacteria in the diseased tissues. The lowering of the animal's vitality and cell resistance by the conditions mentioned, make it possible for these ordinarily harmless bacteria to penetrate into the blood and thence into the lungs and other organs and cause inflammations which may prove fatal. But the harmful activity of

these common hog-yard or dirt germs can be prevented by proper herd management. Dry and comfortable sleeping quarters provided with clean bedding at proper intervals, and a nutritious ration, are simple and effective means for preventing the ordinary pneumonic attacks which have often been diagnosed as epizootic swine-plague or hemorrhagic septicemia of swine.

There may be an extra virulent type of the hemorrhagic septicemia organism which is highly infectious and fatal for healthy hogs, but up to the present it has not been discovered. Moreover, experimental evidence indicates strongly, if it does not prove definitely, that treatment of swine by the injection of hemorrhagic septicemia "bacterins" is without value, either as a preventive or a cure of the pneumonic and hemorrhagic conditions mentioned.

"MIXED INFECTION" AILMENTS

What has been said about hemorrhagic septicemia of swine is equally applicable to the so-called "mixed-infection" disease of swine.

There are good reasons for believing that the great majority of cases of illness in swine, which are thought to be caused by mixed infections, are in fact cases of hog cholera; altho the case may be complicated with secondary bacterial invaders, which, under ordinary conditions, are quite harmless.

Experiments at the Missouri Agricultural Experiment Station show that the same lesions, or diseased conditions, upon which the diagnosis of "mixed-infection" disease has been based, will develop in pigs which are inoculated with hog-cholera virus and are let run the full course of the disease without treatment; or in pigs which contract cholera from natural exposure and are allowed to die. In conjunction with this it was also shown that the development of these so-called mixed-infection lesions could be prevented by the injection of anti-hog-cholera serum; since other pigs which were inoculated with an equal amount of the same cholera virus and a proper dose of anti-hog-cholera serum, and were allowed to run with the first group of experiment pigs, did not become ill from the vaccination nor contract "mixed-infection" disease from the sick pigs which on post mortem examination showed the so-called mixed infection lesions. This accords with practical field experience in sick herds; a liberal dose of anti-hog-cholera serum stops the outbreak, altho the post mortems show the "mixed infection" lesions.

As secondary factors, cooperating with the highly virulent cholera infection, it is quite probable that some of the common hog-yard bacteria which are swallowed daily and which under ordinary circumstances are quite harmless, may act as irritants to the already inflamed and weakened intestinal tissues, and aid in the production of the "button ulcers" and the diffuse diphtheritic and necrotic intestinal lesions, which in the older and classic literature were regarded as signs of "chronic hog cholera." This diagnosis would still be well to adhere to, because of the probability that in such cases the primary and essential cause of the outbreak in the herd is hog-cholera infection, and because of the probability that a greater number of hogs can be saved by the prompt use of anti-hog-cholera serum, and the prompt application of appropriate hygienic measures, than can be saved by the use of "mixed-infection" vaccines.

These diphtheritic inflammations of the intestines are more liable to develop during cholera attacks if the feedstuffs are of a kind which tend to

cause bowel disturbances. And, as there is likely to be considerable immature and soft corn to feed this fall (unless the ripening season is prolonged and the frost delayed), it is especially important that the hogs which are put upon such feed should be well immunized against cholera before the heavy feeding begins.

"SWINE INFLUENZA" OR "HOG FLU"

In regard to "hog flu," the appearance of which was announced in an adjoining state two years ago (at the time influenza was so prevalent among people), the quite general impression among the conservative veterinarians is that there was no need for the invention of this new term to designate any ailment from which the swine herds were suffering, and that there was no need for any special vaccine to combat the supposed new swine epizootic.

What the new corn crop may bring forth in the way of fancied or real ailments, and new remedies, remains to be seen. But the writer's advice to the swine feeders and veterinarians is to take heed of hog cholera and to defend the herds from this real menace. It is not too soon to begin immunizing the hogs that are to be put on the new corn crop, if the losses from cholera and its complications are to be held within reasonable bounds.

DIAGNOSTIC POINTS

As an aid to diagnosis it is deemed advisable to include a few illustrations and descriptions of the most prominent diagnostic signs or lesions found in hog cholera and its complications. In some cases the diagnosis of hog cholera is easy, while in others it is exceedingly difficult even for the veterinarian who has had years of clinical experience. The information contained herein cannot, therefore, give to the swine-raiser all the aid that may be necessary to make a diagnosis of hog cholera under all circumstances. To avoid errors in diagnosis and delays in applying proper treatment, the swine raiser is advised in all cases where it is feasible to secure the services of a competent graduate veterinarian.

In several counties of the state, however, no resident veterinary practitioner is available and in such territory the swine raisers are for the most part dependent upon themselves both for diagnosis and treatment. In some of these counties even the help of a county agent cannot be had. The descriptions and interpretations of the different figures illustrating the disease conditions are therefore made as simple as the subject matter will permit, having in mind the needs of swine raisers who cannot secure veterinary aid. Besides, in territory where veterinary service is available, a better knowledge on the part of the swine-raiser as to what hog cholera is will lead to more prompt action in calling for professional aid. Experience has shown that the best results in the saving of hogs and in the control of hog cholera is by the intelligent cooperation of the swine raisers and veterinarians.

Nature of the disease.—A definition or statement concerning the general nature of hog cholera will be an aid to diagnosis. Hog cholera is a *specific infectious disease*; that is, it is caused by a *special microbe*, and no outbreak of the disease ever occurs in a neighborhood unless this *special*

microbe is present. An outbreak cannot occur in a herd that is free from the disease until the infection is brought in from some other source by an infection-carrier, as by the purchase of one or more cholera infected hogs, or by the careless use of hog cholera virus in vaccination work, or by contamination of the premises from sick herds in the neighborhood thru drainage or other means. The disease is also a highly infectious or "catching" disease, spreading certainly and quickly thru a herd and to neighboring herds if measures of prevention are neglected, and the death rate among infected swine is usually very high.

The infectiousness, epizootic character, and high death rate are usually sufficient to establish the diagnosis of hog cholera when the outbreak has continued long enough to establish a history showing these characteristics, since there is no other swine ailment to compare with it in these respects. But at the beginning of an outbreak in a neighborhood, before many hogs have died, the symptoms and post mortem findings must be relied upon to determine the diagnosis.

Symptoms.—As to the symptoms, these are by no means always diagnostic; many of the symptoms are the same as observed in illness from other causes. In the very acute type of the disease, hogs may die without having shown any noticeable preliminary stage of illness; usually, however, a period of several days' illness occurs before death, the animal showing evidences of high fever by thirst, the temperature as shown by the clinical thermometer varying from 104 to 107 degrees.

The figure on the cover page shows a very common posture in the cholera-infected pig. In cholera the animal shows extreme weakness and depression and a disinclination to move about, often lying in bed and burrowing in the straw as if to cover up for warmth, and when aroused and compelled to move about an unsteadiness of gait is observed, the hind parts wabbling or weaving from side to side.

Diarrhea is frequently observed, but some pigs are severely constipated. In cases showing diarrhea the discharges at first are usually of a greenish color and later may become black from admixture with blood. In some cases a bloody discharge is seen. In the more chronic cases the discharges are often yellow or ochre colored, the so-called typhoid discharges, which on exposure to air change to a reddish orange color.

Bleeding at the nose and the passage of bloody urine have also been observed in the acute hemorrhagic type of cholera. In some cases the skin, and especially on the belly and inner face of the hams, appears reddened from the rupture of capillary blood vessels.

A husky cough occurs in some infected animals when the respiratory organs are involved, but this occurs also from other causes.

Lesions or disease changes.—A study of the autopsies of numerous unquestioned cases of hog cholera, together with considerable experimental evidence, shows that in addition to defining hog cholera as a "specific infectious disease" it can also be appropriately termed a "blood disease"; or in more technical language, a "septicemia," which implies that the microbic infection or virus lives and multiplies *mainly* in the blood stream rather than in the cellular substance of the various organs thru which the blood circulates. In the most acute type of the disease the hog may die after a

short period of extremely high fever and no well-marked lesions or signs of disease be found in the carcass. Indeed in some cases if the animal is slaughtered at the height of the fever and bled out and dressed as a butchered animal, the carcass and visceral organs cannot readily be distinguished from those of a healthy hog; yet if a small quantity of the blood of such an animal is inoculated into a healthy pig, or if the pig is fed portions of the apparently healthy viscera (the capillaries of which still retain considerable blood), an attack of hog cholera is certain to develop. Hog cholera therefore in its simplest form is a pure "septicemia" (or blood disease). When the veterinarian or the swine raiser makes an examination of a case of this kind and finds no lesions he is unable, without further data, to make a diagnosis. Fortunately, however, so far as diagnosis is concerned, it is rare for an outbreak of hog cholera to occur without showing some positive diagnostic signs early in the outbreak. In fact, the larger number of autopsies show another stage of the disease, namely, the occurrence of numerous minute hemorrhages in the various organs of the body following the rupture of capillary blood vessels. In some cases these hemorrhages are few and occur only in a few organs, while in other cases the hemorrhages are numerous and several organs show the lesions.

The descriptions of this stage or phase in hog cholera will be better understood by a study of the accompanying figures illustrating the hemorrhagic lesions occurring in the several organs.

Lymph nodes.—The lymph nodes (lymph glands or "kernels") show a hemorrhagic condition in hog cholera more constantly perhaps than other structures. The "kernels" in the throat near the angle of the jaw should be examined; these are frequently enlarged from congestion of the blood vessels and show evidences of capillary hemorrhage into the gland tissue when cut across. Some of the lymph glands in other parts of the body, which it is advisable to examine, are the inguinal or flank glands or "kernels"; the bronchial and mediastinal glands, in the thoracic cavity; the portal glands between stomach and liver; and the mesenteric glands in the gut fat. In health these glands are of a grayish or leaden color, while in cases of cholera some of these glands will often be red or even black from the intense congestion with blood, and hemorrhage in the substance of the gland.

Kidneys.—The kidneys perhaps stand next in the constancy of the hemorrhagic lesions. These organs in the great majority of cases of hog cholera show at least a few minute punctiform glomerular hemorrhages; and in some cases the hemorrhages are quite numerous giving the kidney a well-speckled appearance, the so-called "turkey-egg" appearance. (See Figure 2.) The lower or ventral surface usually shows more blood specks than the upper or dorsal surface.

The pelvis of the kidney, the ureters, and the urinary bladder occasionally show signs of capillary hemorrhage in swine affected with hog cholera. Cases have been observed in which the urinary bladder was distended with bloody urine.

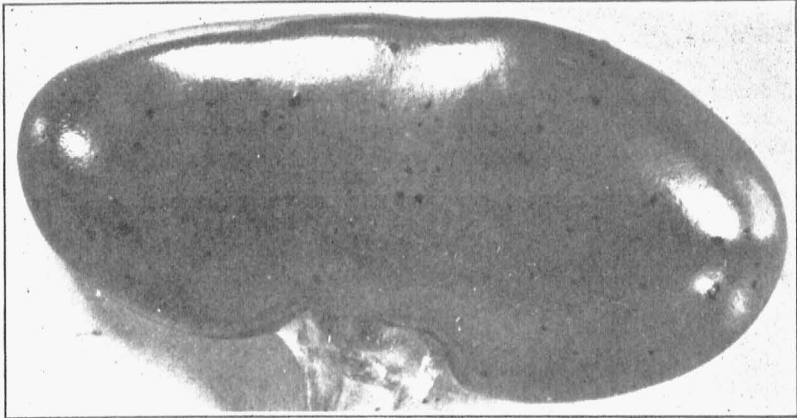


FIG. 2.—Kidney showing hemorrhagic lesion of hog cholera



FIG. 3.—Hemorrhages in heart of pig affected with cholera

Heart.—The heart occasionally, tho not frequently, shows numerous small hemorrhagic spots beneath the pericardium, especially at the upper portion of the heart. (See Figure 3.)

Lungs.—The lungs in many cases are quite normal in appearance; but in other cases, hemorrhages varying in size and number are found scattered over the surface of the several lobes, just beneath the pleural covering. The “blood shot” spots vary in size from that of a pin-head to areas three-fourths of an inch or more in diameter. (See Figure 4.) The cross-section of such a lung also shows hemorrhages in the deeper portions.

Stomach.—The stomach in many cases appears normal both outside and inside the organ, while in other cases spots of hemorrhages are found on one or both surfaces, most frequently on the inner surface in the submucous layer. Occasionally a massive blood clot is

found in the cavity of the stomach of a hog that has died from hog cholera.

Intestines.—The small intestines rarely show hemorrhages either on the outer or inner surface but occasionally the subserous space is well dotted with minute hemorrhages. Such hemorrhages occur more frequent-

ly in the inner coat of the small intestines. Sometimes extravasation of blood takes place thru the mucous coat into the cavity of the gut. Hemorrhagic spots varying in size are observed more frequently in the walls of the large intestines in swine affected with hog cholera. (See Figure 5.) The food contents of the large intestines are sometimes strongly tinged with blood from hemorrhage into the cavity of the gut.

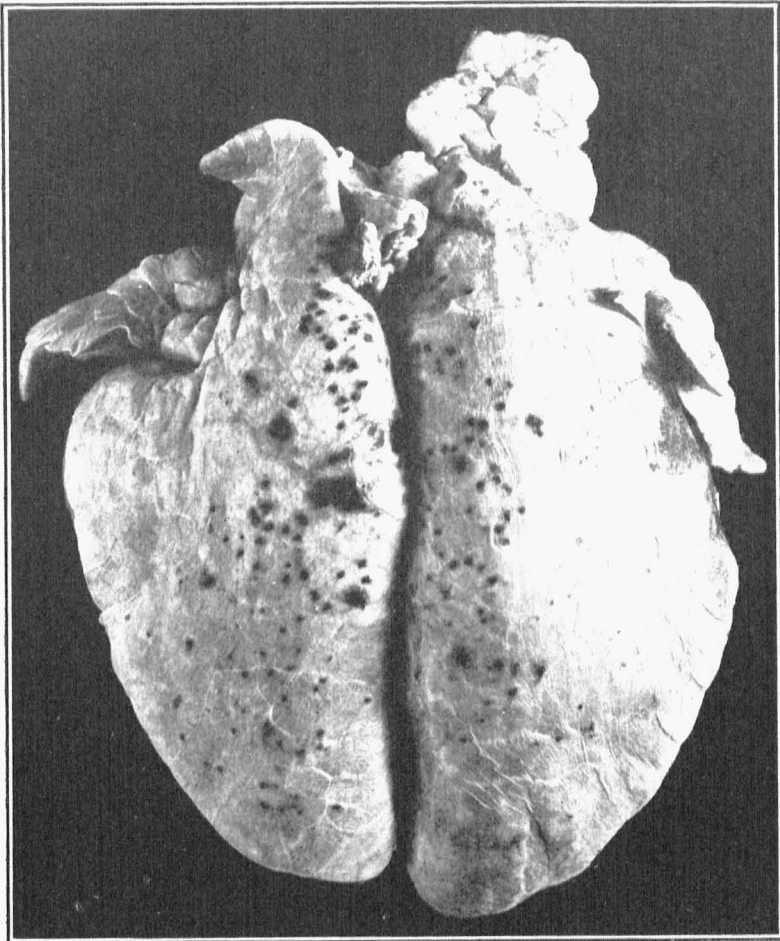


FIG. 4.—Lungs of hog showing hemorrhagic cholera lesions

This well-marked tendency for ruptures of the capillaries to occur in the various organs, resulting in numerous pin-point and larger hemorrhages shows that hog cholera, in addition to being a "septicemia," is also a *hemorrhagic* disease, and might in many cases be appropriately termed a "hemorrhagic septicemia," except for the fact that this term is already used to designate an identical condition which is supposed to be caused by

a different microbe, namely, the "Bacterium suisepiticus" or swine plague bacterium, or as it is now more popularly known the "bacterium of hemorrhagic septicemia of swine." But, as already mentioned in the earlier portion of this circular, the so-called hemorrhagic septicemia organism is probably not, as an independent and primary agent, a serious factor in the production of any epizootic disease among swine. And the probabilities are that the capillary ruptures and resultant hemorrhages are caused by the more highly virulent and toxic infection of hog cholera, and not by the "bacterium suisepiticus," or misnamed "hemorrhagic septicemia" organism; and that when the latter gains entrance into the tissues, this occurs as a rule only as a secondary invader through the lesions or ruptures produced by the hog-cholera virus. For practical diagnosis, therefore, these hemor-

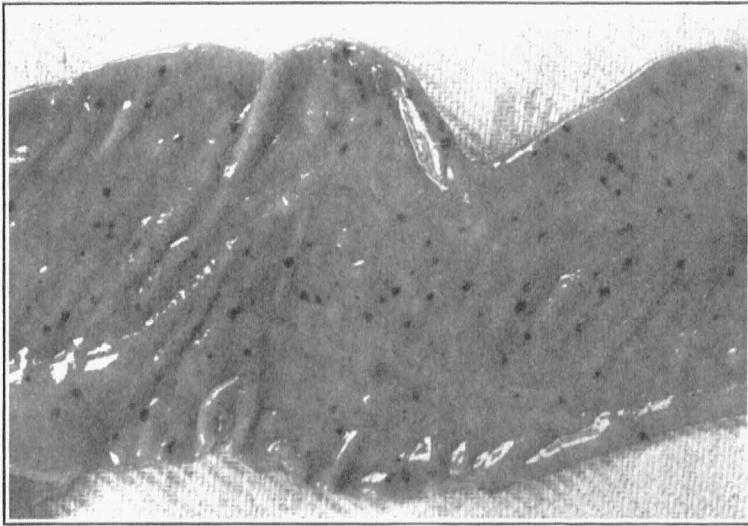


FIG. 5.—Hemorrhages in large intestines of hog affected with hog cholera

rhages should be regarded by the veterinary practitioner and the swine raiser as evidences of hog cholera. Prompt treatment with anti-hog-cholera serum should be given when such lesions are found.

Secondary lesions.—The numerous minute ruptures in the capillary blood-vessels of the lungs and intestines give easy ingress into the injured tissues to any of the hog-yard bacteria which at the time may be present on the mucous surface of these organs; and these micro-organisms, which in the healthy animal are quite harmless or rarely pathogenic, may act as local irritants or "wound infections" to the already *injured* lungs and intestines, and thus in conjunction with the hog cholera infection may give rise to a fatal broncho-pneumonia, when the primary hog cholera lesions occur in the lungs; or to a diphtheritic inflammation of the intestines in cases where the primary lesions of hog cholera are more pronounced in these organs. These secondary lesions of the lungs are shown in Figure

6. It will be seen that in addition to several subpleural hemorrhagic spots on the dorsal surface of the left lung, as at the point "e," and the hemorrhagic lymph-nodes in the space between the lungs, as at the point "d," there are also well-marked areas of solidification from broncho-pneumonia in the right lung. The greater part of the cervical lobe "a," the middle lobe "b," and the anterior outer portion of the posterior or principal lobe, as at the point "c," all show solidification.

There can be scarcely any doubt that the hog-cholera infection, because of its virulency and prolonged vitality in the infected animal, is capable of producing these pneumonic lesions without the intervention of other microbial infections, since attempts to isolate bacteria from a pneumonic lesion by bacteriological methods often fail in cases of hog cholera. But as the conditions at times are quite favorable for the penetration of

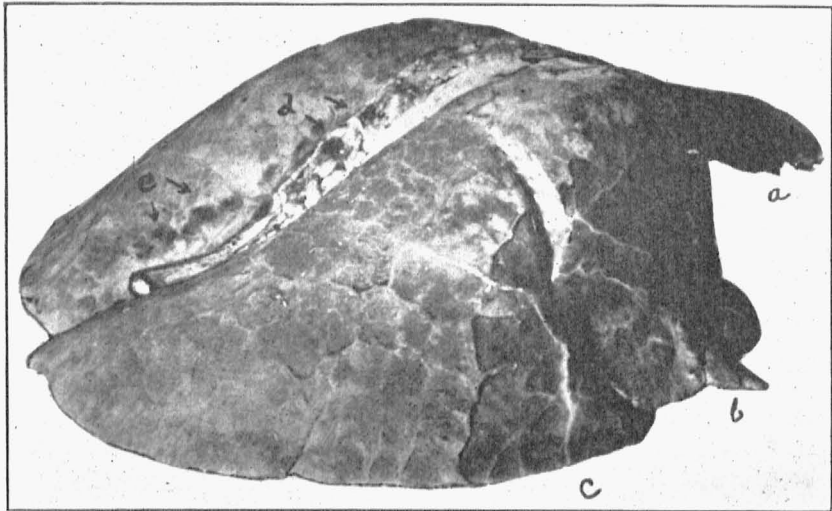


FIG. 6.—Lungs of hog affected with cholera, showing pneumonic areas "a," "b," "c"; hemorrhagic spots "e"; congested lymph nodes "d"

the injured tissues by bacteria of various kinds, which may have been inhaled with the dust of the barn-yard, these bacteria frequently do penetrate the injured lung tissue and can be isolated and studied. Both bacillary and coccus forms have been found in the lungs of hogs which have died from cholera as has been shown in the work of this laboratory. The evidence, however, is lacking that any of these secondary bacterial infections are responsible for serious outbreaks of swine disease, or need to be combated by other measures than good sanitation, proper feeding and shelter, and the proper use of anti-hog-cholera serum.

As to the chronic intestinal lesions which are frequently associated with hog cholera, the development of these can be more readily understood by keeping in mind the earlier stages of cholera in which occur the numerous minute hemorrhages in the mucous and submucous layers of the

intestine, as shown in Figure 5, and by comparing this with Figure 7 showing numerous diphtheritic spots and patches. Figure 8 shows a less diffuse ulceration, one large "button ulcer" and several minute ulcers.

If the pig showing these ulcerative or diphtheritic lesions had been killed a few days sooner the intestines would probably have shown the hemorrhagic lesions instead of the ulcerated or diphtheritic condition.

The invasion of the hemorrhagic cholera wounds by the ordinary hog-yard bacteria or common intestinal flora may add to the irritation and inflammatory action initiated by the hog-cholera infection or virus. Practical clinical experience has shown that the most effective preventive measures against this necrotic enteritis or "mixed infection" bowel trouble are to guard against the initial or hemorrhagic lesions of hog cholera by using liberal doses of anti-hog-cholera serum at the beginning of an outbreak of cholera, or when immunizing a herd by the double-method and to

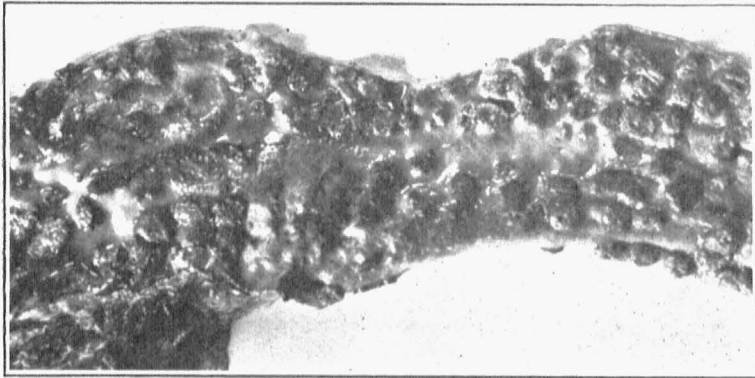


FIG. 7.—Section of large intestines of hog affected with cholera, showing diffuse "diphtheritic" or "necrotic" spots

give proper attention to feeding, and other hygienic measures. If these lesions are found in a herd of swine which has had a "break" following double vaccination, the herd should be revaccinated with anti-hog-cholera serum, and fed for awhile on a soft or thin-slop ration, restricted in amount.

There is some reason to believe that these so-called "mixed infection" intestinal lesions, or necrotic conditions, are in reality a stage in the healing process of the initial hemorrhagic hog-cholera lesion, and not a progressive disease process due to secondary bacterial invaders or "mixed infections." In other words, that what is observed is in fact an effort on the part of the healthy cells of the intestines to separate and slough off the blood-cots or "infarcts" and dead portions of the mucous and submucous tissues which have been killed by the cholera infection; and that the various bacteria found in the necrotic tissues are present merely in the role of harmless *saprophytes* feeding upon the already dead tissues, rather than as disease-producing *parasites* which have killed living tissues. Figure 9 shows "button ulcers" as the healing process was underway. When this

dead or necrotic intestinal tissue is extensive the nutritive functions of the animal are greatly disturbed, and doubtless considerable "cadaveric" or necrotic "toxin" is absorbed into the blood stream and increases the depression of the affected animal. Moreover, under the conditions mentioned, intestinal bacteria may invade the blood stream and be found at times in the spleen, liver and kidneys. But this has little significance as an indication that these invading bacteria are specific disease producers, and

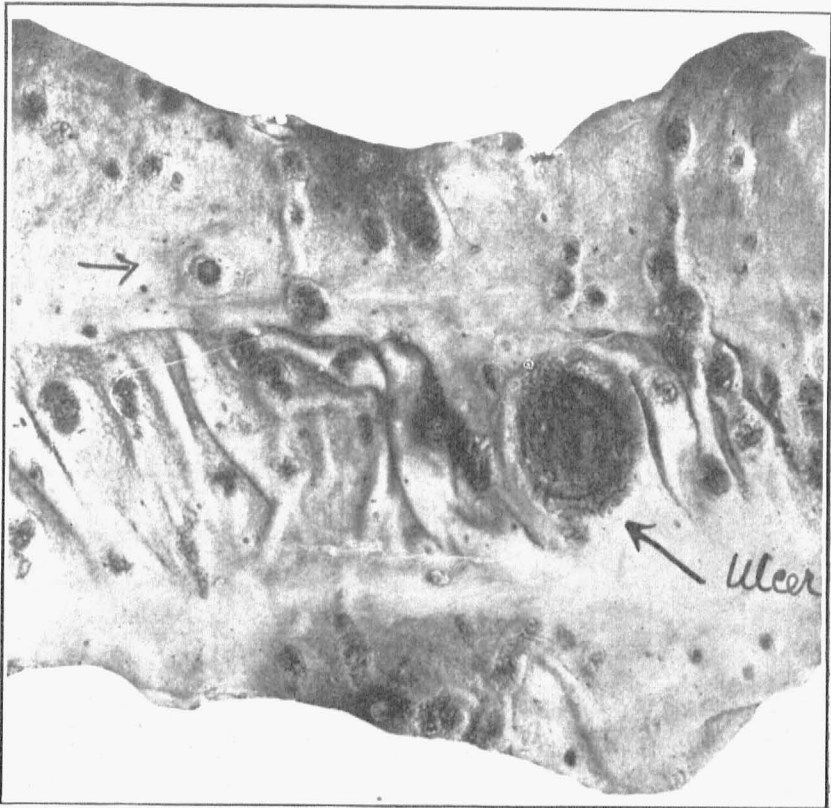


FIG. 8.—Section of large intestines showing more isolated necrotic cholera lesions—a large 'button ulcer' and several small ulcers or necroses

less justification for their use in the form of "bacterins" or "mixed infection" vaccines for the immunization of swine against the occurrence of the necrotic conditions found in the intestinal tract of swine. It should be kept in mind that these bacteria are normal inhabitants of the intestines and if, as *living bacteria* in constant contact with the intestinal mucosa, they have been unable to produce an immunity, it is not probable that when they are grown artificially outside the body, and killed by heat and thus converted into *dead bacteria* or "bacterins," they could give any

practical immunity against the disease-conditions mentioned. The good clinical results following the use of the "mixed infection" vaccines which have been reported from time to time in the veterinary journals by a number of practitioners, as well as the results reported by the trade bulletins of the veterinary biological companies, are probably accounted for by the better care of the herd which is instituted when a diagnosis of "mixed infection" disease is made. The anti-hog-cholera serum which is usually administered at the same time should receive due credit for the good results in preventing further losses in the herd.

The safe conclusion for the swine raiser and the busy veterinary prac-

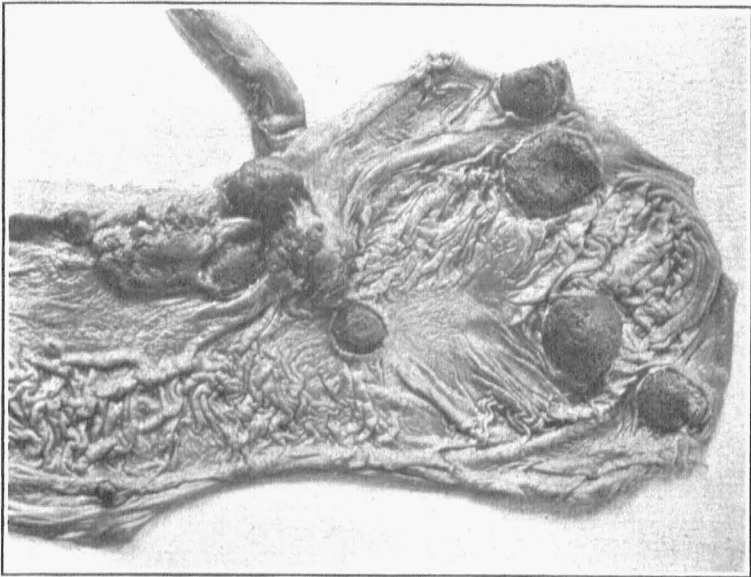


FIG. 9.—Section of cecum and colon showing "healing stage" at margins of button-ulcers

itioner is to regard all the lesions which have been described as evidences of hog-cholera infection in the herd; and the safest action is to vaccinate the herd promptly with anti-hog-cholera serum and to give the herd such special care as to feeding and shelter as the conditions may require.

A research bulletin on some of the phases of hog cholera touched upon in the preceding pages is in preparation, which because of its more technical nature and the incorporation of experimental details will be of special interest to the veterinarians rather than the swine raiser.

SUMMARY OF FACTS TO REMEMBER

1. Hog cholera is caused by a living germ, virus or infection.
2. The disease is contagious, or "catching" by contact with the sick animal or its excretions.
3. Hogs in low vitality from worms, lice, lack of proper nourishment,

poor care, fatigue, overheat or undue exposure to cold are less resistant to the disease than vigorous swine in a good state of nutrition and properly cared for.

4. The anti-hog-cholera serum contains the *protective substances* which prevent cholera, and does not introduce disease; but it gives only a passive or temporary immunity.

5. The "virus" used in the "double" or serum-virus treatment is blood from a hog affected with cholera in the acute form, and if injected without serum produces an acute attack of cholera.

6. The serum and virus when injected at the same time, in proper proportions, into healthy swine which receive proper after-care confer a tolerably lasting immunity.

7. The "virus" remains alive and virulent in the blood of double-treated swine for three or four weeks after vaccination; proper after-care should therefore be given double-treated hogs to avoid a "break" from "vaccination cholera."

8. "Breaks" following double treatment may occur if the virus is a weak or dead virus, the immunity in such cases being of scarcely greater duration than the immunity from serum-alone vaccination.

9. "Breaks" from vaccination cholera following the double treatment may occur if the virus is active and the serum is low in potency. The virus in such a case is not held in check and develops visible signs of illness which may result in the death of several vaccinated animals.

10. "Breaks" from vaccination cholera following the double treatment may occur when active virus and fully potent serum are administered to swine of low vitality. The natural resistance of the animal plus the "serum reinforcement" being insufficient to withstand the disease activity of the virus. Avoid as much as possible giving virus to swine which are out of condition; give serum alone and later apply double treatment. But if this is not feasible, increase the dose of serum considerably when giving the double treatment.

11. "Breaks" from vaccination cholera are liable to occur in swine which are subjected to unusual conditions of fatigue, from long railroad hauls, or excessive handling too soon after vaccination, even tho such swine were in thrifty condition when vaccinated, and were given serum and virus of good quality and proper dosage. Careful attention and light rations for several days may prevent losses, and revaccination in most cases will prove helpful.

12. Bring the double-treated herd onto full feed gradually, and maintain a proper balance of supplements, such as tankage and oil meal.

13. If sickness occurs in a herd of double-treated hogs within three or four weeks after vaccination, cut down the feed at once, separate the sick animals, call the veterinarian, take temperatures, and if autopsies show lesions like those described in the foregoing pages revaccinate the herd with anti-hog-cholera serum.

14. A common fault in vaccinating hogs is to give too small a dose of serum. It is better to give a few cubic centimeters too much than a few cubic centimeters too little. In the former case the loss in extra expense is slight, while in the latter case both the serum and the hog may be lost.