Transmissible Gastroenteritis – Pork Industry Handbook
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pork industry handbook

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Transmissible Gastroenteritis (TGE)

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Among the diarrheal diseases of baby pigs, transmissible gastroenteritis (TGE) is the most deadly and the most feared by swine men. Accurate statistics are not available, but extensive epidemics of TGE occur every winter in the Swine Belt. When the disease strikes a herd during a concentrated farrowing period it is not unusual to lose most of the pigs farrowed over the next two to three weeks.

Clinical Signs—Appearance

TGE is usually a mild disease except in pigs less than about 3 weeks of age and in sows that sicken at or near farrowing. Pigs other than these have a more or less fluid diarrhea for 1 to a few days, and vomiting is occasionally observed. They may not gain, or may actually lose, weight for a week or so, but in most cases they make up these losses later.

The signs in newborn pigs are much more severe. Diarrhea starts 18-30 hours after the pig is exposed to virus. Thus, pigs born in a farrowing house in which a TGE outbreak is going on are born healthy and show the first signs of TGE on the day following birth. Diarrhea that sometimes occurs in pigs during the first hours of life is not TGE.

The first sign seen in baby pigs that are carefully watched is almost always vomiting. This may be missed in pigs housed in pens in which the sows run loose, because they will eat the vomitus. Vomiting is followed very quickly by diarrhea. The first diarrhea, again, can be missed by a casual observer because it is very thin and watery; it runs down the hind legs and drips from the tail. As the disease progresses, it becomes more obvious. The diarrhea thickens, becomes yellowish and is seen in little puddles on the floor.

The pigs are dehydrated, their ears lie back, their eyes are sunken, they are thirsty and will drink water or attempt to suckle even though they become progressively weaker. Most pigs that die of TGE do so in 3-5 days after they are infected, but in some herds deaths may occur earlier. Pigs that have TGE are highly sensitive to chilling, and this may be at least a partial explanation for the rapid deaths sometimes seen. Pigs that live more than 5-6 days will usually recover. In most cases these pigs will do well, but in some herds there may be pigs that never make satisfactory gains thereafter.

Sows that sicken just before or just after farrowing become feverish, they often vomit, refuse feed and have a greenish diarrhea that persists for 1 to a few days. Their milk quantity diminishes and they may even dry up, but in most cases if the litter continues to suckle they will return to normal lactation.

The Cause

TGE is caused by a virus that belongs to the group called coronaviruses. They have projections on their surfaces that appear in electron micrographs like sunflower petals. The virus has an envelope that is easily destroyed by detergents, and it is readily inactivated by warm temperatures, drying, and sunlight. The virus is resistant to acid—this allows it to pass through the stomach and infect the small intestine. It survives for long periods in a cold, dark environment and almost indefinitely when frozen.

How the Virus Causes Disease

TGE virus has a special affinity for the cells that line the small intestine. These cells cover millions of tiny villi that project into the intestine to provide a huge surface that functions to digest and absorb nutrients from ingested food (Fig. 1). When TGE virus enters these cells it multiplies and, in the process, kills the cell. This process takes 4-5 hours. When the cell is killed, thousands of virus particles are released to infect other cells on other villi. After 4-5 cycles of virus multiplication almost all of the digestive cells in a

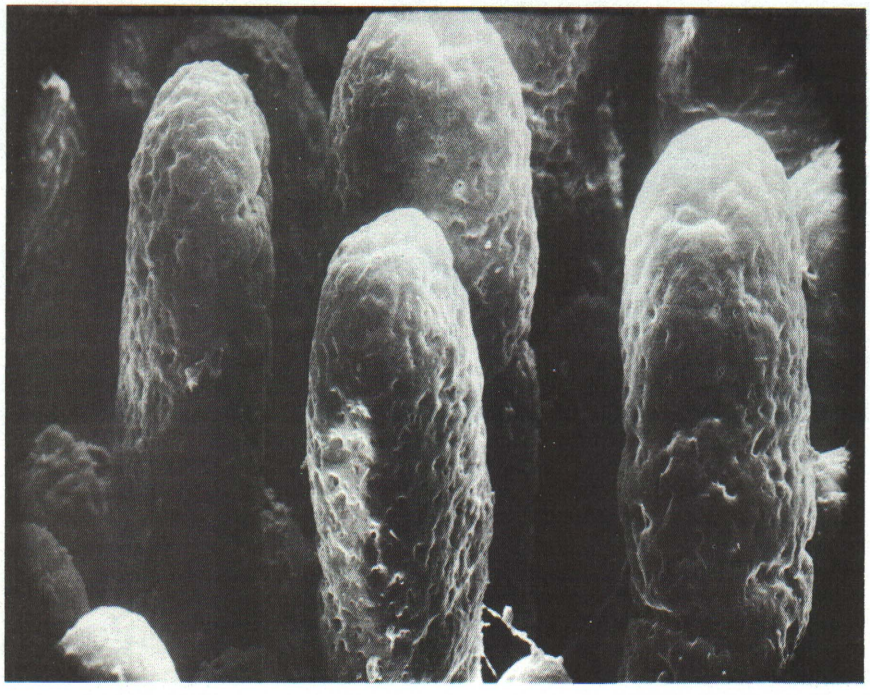

Figure 1. Scanning electron micrograph of normal small intestine, showing villi that line the intestine. These projections increase the surface area and are covered with the cells that digest and absorb nutrients from the feed. x200. Courtesy of Dr. G. L. Waxler, Department of Pathology, School of Veterinary Medicine, Michigan State University.

newborn pig are killed. The small intestine is now covered with immature cells that cannot function in digestion or absorption (Fig. 2).

Food (milk) is taken in, but the nutrients in it cannot be digested nor absorbed so it passes through the pig as diarrhea, taking body water and essential salts with it. The diarrhea upsets the balance of salts in the blood so that it becomes acid. The loss of water causes dehydration, and failure to absorb energy causes starvation. The pig dies of a combination of these factors, with complications of stress and secondary infections often involved.

Diagnosis

An accurate diagnosis is necessary to establish treatment and management of the infected herd. A strong presumptive diagnosis of TGE may be made on the basis of the clinical picture in many outbreaks of TGE. The pattern of a rapidly spreading diarrheal disease involving breeding stock and growing pigs as well as piglets is very typical of TGE but is not always seen. It may be different, for instance, where no baby pigs are present or when part of a herd is immune. Postmortem finding of severe shortening of the villi of the small intestine as shown in Figure 2 is indicative of TGE, but some degree of villous atrophy may occur in other diarrheal disease of pigs, notable rotaviral infection, so these lesions require interpretation.

Many diagnostic laboratories are equipped to do a fluorescent antibody test which can detect TGE virus-infected cells in the intestines. This test is specific and can be done in less than a day; but it requires the killing of 1 or more pigs, preferably at the earliest stage of infection, to obtain intestinal tissue. A diagnosis can be made by using serological tests on blood samples taken at the time of disease and 2 or 3 weeks later. Usually such a retrospective diagnosis is made too late to influence treatment or management of the affected swine, but it may influence the long-term management of the herd.

In some herds, an atypical pattern of TGE occurs in pigs whose mothers are immune owing to a previous exposure to the disease. In such herds, diarrhea occurs mainly in suckling pigs over 8 days of age or in recently weaned pigs. This form of TGE, commonly referred to as enzootic TGE, occurs mainly in herds that are on a frequent or continuous farrowing schedule, presenting a situation where susceptible pigs are generally present to perpetuate the infection. An accurate diagnosis of enzootic TGE can be difficult, and it must be differentiated from diarrhea due to rotavirus since the latter also occurs mainly in pigs of this age group.

Immunity

One of the most effective and widely used methods of combating viral diseases is immunization, but in spite of considerable effort by universities and commercial houses, a completely safe and effective TGE vaccine is not available at this writing. Immunity to TGE and other diseases of the intestine is a complicated subject and still incompletely understood.

The problems with immunity to TGE stated briefly and with oversimplification are: To be effective against TGE, pigs must have immunity during the first days of life. A sow that has been infected naturally will give immunity to its pigs through its colostrum and milk. Its pigs will be immune, however, only as long as they suckle the immune sows. If they stop suckling they become susceptible within hours because their immunity depends upon the presence of milk antibody in the gut.

A TGE vaccine is available commercially and can be used to vaccinate pregnant sows to provide some temporary protection to their suckling pigs. This type of vaccine, as presently available, provides only limited protection against infection but will tend to reduce death losses in young pigs. The practical problem that has not been solved is to develop a safe vaccine that will stimulate the same antibodies in sow's milk as natural infection does. Injected vaccines cause antibody to appear in colostrum (the first milk), but 1-3 days after farrowing, and thereafter, only low levels of antibody occur in milk. Thus, the pigs of a sow given an injected vaccine may be protected very early in life while suckling colostrum but not later as the colostrum is replaced by milk.

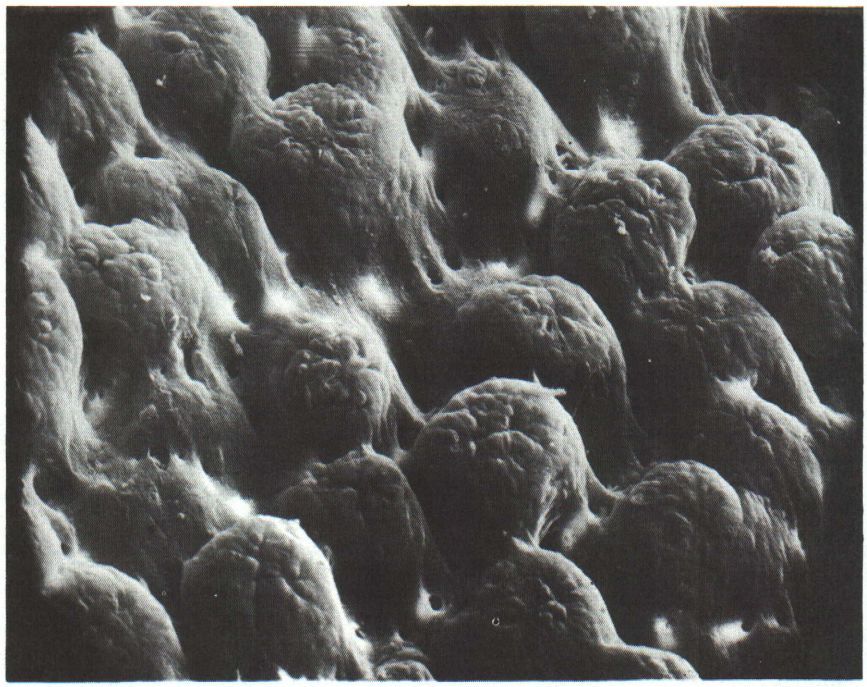

Figure 2. Scanning electron micrograph of the small intestine, as it appears after infection with TGE virus. The surface cells are killed and shed resulting in shortening of the villi and loss of the ability to digest and absorb nutrients. If the pig survives, villi will regain their original form in 1 week to 10 days. Courtesy of Dr. G. L. Waxler, Department of Pathology, School of Veterinary Medicine, Michigan State University.

It is possible to produce substantial immunity by planned infection of sows with fully virulent TGE virus. This is dangerous because a planned infection may not be contained; it may be spread to other swine in the same herd or to other herds in the area and, actually, start an epidemic. Planned infection with virus obtained in the form of intestines of infected pigs can, however, be an important management tool when it is used judiciously in herds that are already infected.

A theoretically possible approach to immunization would be to give newborn piglets a modified virus by mouth. This would require a virus that is able to stimulate interference with the growth of wild TGE virus without causing disease on its own. So far, this has not been attained.

Epidemiology

The most cost-effective means of controlling disease of livestock are based on sanitation; that is, keeping the animals and causation separated. Good sanitation procedures depend upon knowledge of the epidemiology of the disease in question. There are still many unanswered questions as to how TGE virus survives and spreads in nature because such research requires keeping swine for long periods in isolation. It is time-consuming and expensive, and relatively little has been done. Thus, what is stated here as fact may have to be revised as new knowledge is developed.

TGE is a disease primarily and, as far as is known, exclusively of swine. No reservoir of infection other than swine has been identified. Dogs and foxes can become infected with TGE virus, and they may shed the virus in their stools for up to 2 weeks. They could be involved in herd-to-herd spread of virus during an epidemic but not likely in the survival of the virus from year to year. Starlings tend to flock into feedlots during the winter when TGE is most prevalent, and circumstantial evidence suggests that they may be involved in herd-to-herd spread of TGE virus during epidemics. Attempts to infect starlings with TGE virus have failed, but virus can survive in their intestines for some hours. Thus starlings could eat feed contaminated with virus at one farm and shed the virus in their stools a few hours later at another farm. It is also possible that starlings carry virus from herd to herd on their feet or feathers. There is nothing, however, to indicate that they function to keep TGE virus alive from one season to another.

The most important animals involved in the maintenance and spread of TGE are swine and man. Swine are the reservoir of the virus, and man, through his activities, helps spread the virus from herd to herd.

The natural route of infection of pigs with TGE virus is by mouth or, in close quarters, virus may be airborne and pigs may be infected by inhaled virus. Virus multiplies in the gut and is passed out in the stools in which it is available to infect other pigs. The quantity of virus in the diarrheic stools is very high (up to a million infectious doses per gram) during the first days of the disease. It decreases as the pigs recover and the stool becomes solid. With one questionable exception, virus has not been found in the feces of pigs for more than 2 weeks after infection. Virus may persist in the gut and possibly the respiratory tract for as long as 2 or 3 months. Whether this virus ever gets out of such pigs to start new infections is a matter of question.

It is known that TGE virus can persist for long periods under conditions in which new pigs are continuously added to a group. In large herds in which continuous farrowing is practiced, for instance, most of the sows may be immune and their pigs will be totally or partially protected while they are suckling the sows but will have no protection after weaning. As discussed under "Diagnosis," this pattern of enzootic TGE in a herd can be difficult to diagnose.

The disease in weaned pigs is not generally fatal, nor distinguishable clinically from other diarrheas that occur after weaning; but such a herd may provide a reservoir of TGE virus which may escape and infect other herds when conditions are favorable to its spread. It seems logical that other situations in which pigs are continuously assembled, such as feeder pig concentration points, may also serve to maintain TGE virus, but this has not been documented.

The important means of spread of TGE virus between herds is stool (feces) from recently infected pigs. It can be carried between herds most effectively by movement of pigs but, also, by anything that is likely to be contaminated

with manure and move between herds. This includes equipment, feed, trucks, and people. People may carry virus on their hands and clothing as well as on their shoes or boots.

Almost all new TGE outbreaks occur in the winter. This can be explained at least partially by the fact that the climatic conditions of winter, that is, low solar radiation due to long nights and cloudiness, and low temperatures, favor the survival of the virus as it is carried between herds in pig stools. The conditions of intense solar radiation and high temperatures that occur in the summer almost eliminate the chance for virus to be carried between herds. Also of possible importance is the tendency for large numbers of starlings to feed close to swine in the winter months, especially after a snowfall.

Treatment

As is the case with almost all viral diseases, no drugs are effective against TGE virus in swine. Lacking specific antiviral drugs, treatment must be directed at the effects of the virus rather than at the virus itself. As was indicated above, the cause of death in TGE is starvation, dehydration and acidosis. It would be possible, theoretically, to replace all of the water, nutrients and electrolytes that are lost through diarrhea by injecting them intravenously or subcutaneously. To some extent this has been done in the laboratory, but the process is expensive and time-consuming and is still not practical on the farm. It is possible, however, to alleviate or at least reduce dehydration by supplying drinking water and to decrease the demand for energy by keeping pigs warm.

Doing two things for TGE-infected pigs—keeping fresh water before them at all times and providing a draft-free place with a temperature of 90+ F.—can significantly reduce losses especially in pigs that are 3-4 days or more of age at the time they are infected. Pigs that are infected during the first day of life do not cope as well.

In some cases secondary bacterial infection appears to be involved importantly, and antibiotic treatment may be advisable even though it will not affect the course of the viral infection in the pig.

Management of TGE-Infected Herds

Management is the most effective and least expensive means of reducing losses in a TGE-infected herd. It should be directed not only at saving pigs already infected, but also at preventing infection of pigs to be farrowed and, very importantly, preventing spread to other herds in the area.

It is, however, very difficult to make blanket recommendations since each herd is different in facilities, farrowing schedule, marketing aims, availability of labor and many other factors that influence management discussions. This is where a veterinarian who understands in detail the pathogenesis, epidemiology, and immunity to TGE (which were briefly outlined above) can be most useful. Some procedures to be considered follow:

Pigs born to non-immune sows in a room in which other pigs have TGE are almost sure to break out with TGE on the second day of life. Therefore, sows to farrow in the 10 days or 2 weeks after an outbreak starts should be moved to other quarters. In addition to reducing the probability that their pigs will become infected, this shortens the time that the farrowing room will be contaminated. Individual houses with attached pens, separated from each other by a few feet, are ideal but not usually available on modern farms. It is usually possible, however, to find some accommodation for sows outside of the infected farrowing house even though it otherwise would be considered inadequate. It is often surprising how effective this procedure can be. Even sows that farrow as early as the first night after removal from the contaminated farrowing house may have litters that remain healthy if care is taken to maintain their isolation.

Deliberate infection of sows with the virus already on the farm may be useful. This is best done by chopping or grinding the virus-containing intestines of newly infected pigs in water, and adding the slurry to the sows' feed. The infected sows develop some immunity in about 10 days and it becomes stronger during the next weeks. Such sows may then be moved into the farrowing house. The effectiveness of this procedure is increased if, in the meanwhile, all sick pigs are removed and the room is thoroughly cleaned and allowed to stand at about 70-80 F. for 2 or more days.

Under some circumstances, it may be useful to deliberately expose growing swine as well as sows. The reason for this is that it may shorten the total time the disease is active on the farm over what it would be if the infection were to progress naturally through the herd.

Decisions concerning planned infections should be made with professional consultation to assure proper handling of the virus and infected animals. It is possible to spread agents other than TGE virus in this way, and improper management could result in swine being infected at the wrong time, or the infection may be spread to swine other than those intended.

Preventing spread of TGE to other farms is an important responsibility. Dead pigs should be incinerated or at least kept in a container so they are not available to dogs or vermin that may travel between farms. Workers should not go to other farms or to places where other pork producers gather without a complete change of clothing.

A perennial question raised by pork producers is how long one should wait before infected or exposed swine can be safely moved into other herds. A common recommendation is that swine should not be moved between herds for at least 1 month after the last signs are seen in the herd. This period is somewhat arbitrary since it has been shown that virus may actually persist in pigs for longer periods, but no cases of spread from swine sold after such a time have come to our attention. The actual time should be based upon such factors as the need for the sale, the possible consequences of transmitting infection, the possibility of quarantine of the pigs in the herd receiving them, the time of year and an understanding with the new owner.

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