pork industry handbook

MICHIGAN STATE UNIVERSITY COOPERATIVE EXTENSION SERVICE • EAST LANSING, MICHIGAN

Mycobacteriosis (Tuberculosis) in Swine

Authors
Janet B. Payeur, USDA/NVSL, Ames, Iowa
J. Glenn Songer, University of Arizona

Reviewers
John R. Cole, Jr., University of Georgia
Ralph F. Hall, University of Tennessee
John and Teri Peters, Twin Falls, Idaho
Charles O. Thoen, Iowa State University

Introduction and History

Mycobacteriosis, also called tuberculosis, is found in about 0.4% of all hogs slaughtered under Federal inspection (based on United States Department of Agriculture [USDA], Food Safety and Inspection Service [FSIS], records for 1990) and probably costs the swine industry between $5.1 and $6.3 million annually. This is not a large amount compared to losses from other swine diseases. Although there are relatively few infected herds, the economic losses can be devastating to those producers that have the disease in their herds.

Mycobacteriosis in pigs bears almost no resemblance to the disease in cattle or humans. The disease in pigs has no apparent affect on the health of the animal. Apparently it cannot be transmitted to man, either by direct contact or by eating pork products. Lack of transmission of the disease from pigs to man cannot be proven, however. Thus, meat inspection regulations formulated in 1972 call for special handling of carcasses in which evidence of mycobacteriosis is found. Economic losses occur to the swine industry because of these regulations.

Tuberculosis has been largely eliminated in cattle and poultry. Tuberculin testing of cattle with subsequent slaughter of reactors, and in some cases depopulation of entire herds, has lowered the prevalence of the disease to about 0.001% (FSIS, 1990 records) in slaughter cattle. Similarly, the poultry industry has changed to all-pullet flocks and has essentially eliminated tuberculosis. Elimination of older birds has been an effective control measure in this industry. The rate of condemnation for tuberculosis is 0.0001% in light fowl (FSIS, 1990 records).

It has been assumed by many that eradication of tuberculosis from cattle and chickens would automatically lead to its eradication in swine. This has not been the case, however, and mycobacterial infections in swine remain a problem for pork producers today.

Etiology

Historically, the primary agents of mycobacterial disease in swine are the same as those causing tuberculosis in other animals. The disease is transmitted through animal to animal contact. Early in the 20th century when tuberculosis in cattle and man was more prevalent, mycobacteriosis in swine was either *Mycobacterium bovis* or *M. tuberculosis*. By 1925, however, *M. avium*, the cause of tuberculosis in birds, began to occur more frequently in swine. The most common serotypes of *M. avium* in pigs are 1, 2, 3, 4, 6, and 8. Outbreaks of disease due to these serotypes appear to have originated in soil, contaminated litter, usually sawdust, wood shavings or straw and contact from infected fowl. Today isolation of mycobacteria other than *M. avium* from swine, is uncommon (less than 4%; National Veterinary Services Laboratories [NVSL]; 1990). From 1985 to 1990, the NVSL isolated *M. bovis* from swine only 4 times. In each case these pigs were on the same premises with *M. bovis*-infected cattle.

The public health significance of *Mycobacterium avium* complex infections in man is now recognized. The most common serotypes of *M. avium* complex reported from patients with acquired immune deficiency syndrome (AIDS) are serotypes 1, 4 and 8. They are among the most virulent of the known serotypes and are most likely environmental in origin. Since *M. avium* and other mycobacteria abound in the environment and therefore occur in food and drinking water, it is not surprising that they are present in the human alimentary tract. Thus the alimentary tract could be the source of frequently disseminated *M. avium* infections in patients with AIDS.

Rhodococcus equi infection in swine also produces a localized lesion that resembles mycobacteriosis microscopically. The earliest reports of *R. equi* infection in pigs were made during the

1930's, and isolation of the organism has been reported frequently since then. *Rhodococcus equi* is common in the soil of hog pens, and infection with this organism occurs about as often in swine with or without mycobacteriosis. The importance of *R. equi* infections to the swine industry is unknown.

In summary, although other bacteria can cause diseases resembling swine mycobacteriosis, *M. avium* is responsible for nearly all reported cases (96%; NVSL, 1990) in countries with *M. bovis* eradication programs. There is no evidence that swine are the source of *M. avium* infections in man. The environment is the most likely source for both man and animals.

Pathogenesis

Pigs usually become infected with *M. avium* by ingesting the organism. After ingestion, the organism penetrates the wall of the pharynx near the tonsils or the wall of the small intestine and becomes localized in the mandibular and mesenteric lymph nodes respectively. Small areas of infection develop in these lymph nodes, and the organisms rarely escape these initial sites. As a result, the health and condition of the infected pigs usually are not affected, and it is often impossible to establish a clinical diagnosis of mycobacteriosis in these animals. *Mycobacterium avium* also has been isolated from the lymph nodes of swine that were negative to skin tests, presented no lesions in any tissue, and had no signs of illness.

USDA Regulations

Lesions (granulomas) in the lymph nodes of infected pigs are found at slaughter. These granulomas are small abscesses that are detected by repeatedly slicing the lymph nodes with a knife. Before 1972, tissues with lesions were trimmed and discarded. In 1972, a new USDA regulation required all carcasses found to have 2 isolated lesions of mycobacteriosis to be cooked at 170° F for 30 minutes. For example, if one lesion is found in the mandibular lymph node and one near the mesenteric lymph nodes, a carcass was classified "passed for cooking" or PFC. This step was taken because tissues of infected swine were suspected as a potential source of infection for humans. Carcasses processed in this manner lose most of their commercial value, and the additional labor in cooking is an added expense. Also, many processing plants have no facilities for cooking, and the carcasses are subsequently condemned. When lesions are found in only one site such as the head or small intestines, the affected part is condemned and the carcass is passed without restriction.

During 1979 and 1980, studies were conducted at the National Animal Disease Center to determine the temperature and time needed to effectively eliminate mycobacteria from edible tissues and meat products during processing. When wieners were processed at 150° F for at least 10 minutes, 99.9% of added mycobacteria were killed. Subsequently, the FSIS of the USDA proposed a revised set of processing guidelines for PFC carcasses. Since most *M. avium*-infected pigs are PFC (14,997 in 1990, FSIS records) and few are condemned (3,437 in 1990, FSIS records), these proposed changes to lower the temperature for cooking carcasses would virtually eliminate the mycobacteriosis problem for pork producers and packers. However, they have not been implemented because of anticipated bad publicity for government agencies and the pork industry.

Epidemiology

Because diagnosis of mycobacteriosis in the live animal is usually impossible, the prevalence of the disease must be determined from post-mortem findings by meat inspectors. The prevalence of lesions was about 0.4% in hogs slaughtered under Federal inspection in 1990. The actual infection rate may be higher since mycobacteria can be cultured from lymph nodes with no visible lesions and because some lesions may go undetected. Moreover, since infection with *R. equi* may be misdiagnosed as that caused by *M. avium*, the reported rate of mycobacteriosis may be higher than the actual rate.

Tuberculous chickens may continue to be a primary source of infection for swine, although other environmental sources may be more significant. Garbage feeding is a possible, but infrequent, means of spreading swine mycobacteriosis. Improper handling of chicken wastes fed to swine also may allow transmission of the disease. Soil and water are other possible reservoirs of infection for pigs. Pathogenic mycobacteria may survive for more than 4 years in soil and litter contaminated by chickens with tuberculosis.

Studies have shown that sawdust or wood shavings used for bedding may be a source of mycobacteriosis in swine. *Mycobacterium avium* is often found in samples of sawdust and wood shavings where it survives for long periods. The mycobacteria may multiply under proper conditions of moisture and temperature which could explain the seasonal occurrence of the disease in some herds. Seasonal changes may produce less favorable conditions for survival of organisms in wood shavings and thus cause the infection rate to decrease.

The presence of infected sites in the intestinal wall with subsequent pig-to-pig transmission probably is due to shedding of mycobacteria in the feces. Mycobacterial infections of lungs, mammary glands, and uterus also may occur with the potential for transmission of organisms from these sites. Thus, the addition of infected breeding stock could introduce the disease into a herd, and transmission from infected sows to their litters may maintain the disease within a herd.

Many species of wild birds are infected with *M. avium*. The disease has been transmitted to sparrows and pigeons either caged or associated with domestic poultry. Prevalence of the disease in starlings may be as high as 5%.

Diagnosis

Infection in pigs exposed to *M. avium* is usually limited to the lymph nodes of the head and the digestive tract and rarely spreads to other locations. Diagnosis of mycobacteriosis by physical examination of the live pig is usually impossible.

Visual examination of infected sites at slaughter can not differentiate lesions of mycobacteriosis from those caused by other microorganisms or conditions; a confirmed diagnosis should be based on microscopic examination, isolation, and identification of mycobacteria from these sites.

Diagnosis of mycobacteriosis in swine on a herd basis is important and usually depends on detection of infected lymph nodes from pigs at slaughter. When mycobacteriosis has been confirmed by microscopic and bacteriologic examinations, the producer should work with a veterinarian to determine potential sources of the infection and alter management practices to eliminate them if possible.

Tuberculin skin testing has been used for the study of swine mycobacteriosis. The amount of tuberculin used and the site of injection have varied depending on the investigator. The recommended method for a tuberculin skin test in swine is an intradermal injection of 0.1 ml avian PPD in the dorsal surface of the ear. The response to injection is read and recorded 48 hours later. Positive reactions usually include swelling and redness, and they may vary in size and intensity. Hemorrhage and ulceration may occur at the injection site.

The reliability of the tuberculin test when used on individual pigs has been questioned. The tuberculin test can be used successfully as a herd test although false positive and negative reactions occur. No other tests for diagnosis in the live animal are currently in general use.

Prevention and Control

Control of mycobacteriosis in swine is difficult because no vaccine is available, and the preventive use of drugs or antibiotics in feeds is either illegal or of unknown value.

Preventing the disease in noninfected herds is more effective than trying to eliminate the disease from infected herds. It is important not to mix swine and poultry production activities on the same farm. Feeding uncooked garbage, unpasteurized milk, or other materials that might contain viable mycobacteria to pigs must be avoided. Breeding stock should be purchased from mycobacteriosis-free herds (those in which no lesions of tuberculosis are found in slaughter pigs). This measure is less important since transmission of mycobacteriosis from pig to pig is rare.

Efforts should be made to prevent all contact between hogs and wild birds. The potential for transmission of mycobacteriosis from infected wild birds to pigs is probably slight but must be considered.

Hogs should not be housed in old poultry buildings unless they have first been thoroughly cleaned and disinfected. The use of woodshavings for bedding, especially in farrowing buildings, should be eliminated. Some producers have used woodshavings with no problems, but others have been forced out of business because of mycobacteriosis. Woodshavings should be kept dry at the sawmill and on the farm and protected from contamination by wild birds.

There are few options for eliminating mycobacteriosis from infected herds. First, producers may depopulate the herd and then repopulate with stock from mycobacteriosis-free herds. Little is known about decontamination of infected soil since mycobacteria can survive in this environment for at least 4 years. To avoid such problems, concrete lots should be used whenever possible. Concrete surfaces and equipment including farrowing crates and feeders must be disinfected with a phenol-based disinfectant such as Amphyl® or a 2 to 3% cresylic acid solution. Quaternary ammonium disinfectants such as Roccal® will not kill mycobacteria. Mycobacteriosis will recur if the source of infection cannot be effectively decontaminated or if replacement stock is not separated from the source.

Second, potentially infected gilts can be kept to increase the herd size or replace older breeding stock. Because lesions caused by ***M. avium*** usually disappear with age, older sows usually pass standard inspection.

Third, producers may choose to endure the 6-month period until all exposed pigs have been slaughtered if the source of infection such as infected bedding can be found and eliminated.

Mycobacteriosis increases the need for mandatory identification of slaughter hogs. When mycobacteriosis is diagnosed, a producer is free to send the hogs to slaughter through a public market and force the packer and other producers to share the economic loss. The ability to trace hogs with mycobacteriosis to the herd of origin would help solve this problem.

Summary

1. Swine mycobacteriosis causes an annual loss of between $5.1 to $6.3 million to the pork industry and is found in 0.4% of all swine slaughtered under Federal inspection.

2. Economic loss is not from death or illness of pigs but from the loss of carcasses passed for cooking and condemned for mycobacteriosis.

3. The primary cause of swine mycobacteriosis is ***M. avium***, the cause of tuberculosis in poultry.

4. The source of infection for pigs may be infected poultry or other birds, uncooked garbage, the environment (soil, woodshavings, water), and possibly other infected pigs.

5. Clinical diagnosis of mycobacteriosis in the live pig is usually not possible. The occurrence of the disease in a herd is best diagnosed by observing probable sites of infection in lymph nodes at slaughter and examining these lesions microscopically and bacteriologically.

6. Practical immunization and drug therapy are currently not available. The disease is best prevented by careful management of swine feed sources and the environment.

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