Causative Agents

Mycoplasma hyopneumoniae is the causative agent of mycoplasmal pneumonia in swine. Infection with M. hyopneumoniae alone induces a mild, chronic pneumonia characterized clinically by mild cough. However, infection with M. hyopneumoniae alone is rare. M. hyopneumoniae's role in swine respiratory disease is generally through its interaction with other viruses and bacteria. M. hyopneumoniae's interaction with the other disease causing organisms in the lungs of pigs results in either enzootic pneumonia or more recently, the porcine respiratory disease complex (PRDC). The most common organisms isolated from pigs infected with M. hyopneumoniae and exhibiting clinical signs of PRDC include porcine reproductive and respiratory syndrome virus (PRRSV), porcine circovirus type 2 (PCV2), swine influenza virus (SIV), Pasteurella multocida, Streptococcus species, Actinobacillus pleuropneumoniae (APP), and Haemophilus parasuis. Other pathogens isolated from the lungs of pigs can be involved as well and the interaction with mycoplasmal pneumonia can work both ways. While bacteria such as P. multocida appear to increase the severity of mycoplasmal pneumonia, the presence of M. hyopneumoniae increases the severity and duration of pneumonia caused by PRRSV infection.

M. hyopneumoniae colonizes the cilia in the lower airways of the respiratory tract of pigs. M. hyopneumoniae does not colonize in the nose, but can be isolated there sporadically following infection. M. hyopneumoniae are relatively slow growing and pneumonia develops a minimum of 2-6 weeks following exposure. The severity of pneumonia is quite variable. M. hyopneumoniae attachment to the cilia damages and diminishes their ability to move foreign substances, including bacteria, up and out of the respiratory tract. This damage to the fine cilia that line airways to clear debris from the respiratory tract (mucociliary apparatus) plays a role in the increased ability of other pathogens to cause pneumonia in mycoplasma infected pigs. In addition to the detrimental effect on the cilia, M. hyopneumoniae affects the respiratory immune system. M. hyopneumoniae infection attracts white blood cells, primarily lymphocytes and macrophages, into the lung resulting in pneumonia. However, the lymphocytes and macrophages, which are important cells of the immune system, are also stimulated by M. hyopneumoniae non-specifically resulting in inflammation and alteration of the immune system in the respiratory tract. Thus, M. hyopneumoniae diminishes the ability of the respiratory tract to respond to other pathogens and is thought to be an important mechanism by which M. hyopneumoniae increases the severity of respiratory disease induced by other pathogens especially viruses like PRRSV.

Recent research has found antigenic variation and differences in the genetic makeup and virulence between M. hyopneumoniae isolates. The importance of these differences with respect to diagnostic assays and vaccine efficacy is still under investigation.

Transmission

Transmission of M. hyopneumoniae occurs both via carrier dams to their pigs during lactation and via infected pigs to susceptible pigs. Pigs can be infected with M. hyopneumoniae at any age. Depending on the production system, pigs usually do not develop clinical pneumonia until they leave the nursery and are housed in the growing-finishing area with
older pigs. If the sow herd is heavily infected with M. hyopneumoniae, suckling pigs can develop clinical pneumonia at an earlier age. Infection and pneumonia at early ages is frequently associated with continuous-flow operations, when PRRSV is circulating in the nursery and when younger pigs are commingled with older pigs. Recently, early age infection has been associated with the introduction of non-infected, naïve breeding age gilts into infected sow herds. In this case, the gilts are infected later in life and are apparently more infectious to their piglets compared to systems where replacement gilts are infected at a younger age.

Transmission of M. hyopneumoniae can occur via aerosol spread. Possible aerosol transmission between farms has been reported and needs to be considered for biosecurity purposes. While long range aerosol transmission may be possible, most aerosol spread occurs across short, direct distances or direct nose-to-nose contact between animals. The primary spread of M. hyopneumoniae occurs as infected pigs cough the organism out of the respiratory tract and into the environment where it is inhaled by or otherwise contaminates susceptible animals.

Prevalence of Infection

Most commercial swine herds are infected with M. hyopneumoniae. However, recent eradication efforts have lead to an increase in M. hyopneumoniae-free herds. In a herd of pigs without obvious clinical signs of infection (cough) from M. hyopneumoniae infection, typical lesions may be observed in the lungs at slaughter. M. hyopneumoniae has been isolated from clinically normal lungs and is probably never completely cleared from the airways of infected pigs. Thus, pigs without clinical disease can carry the organisms and transmit them to susceptible animals.

Clinical Signs of Infection

Typically, mycoplasmal pneumonia is seen in pigs in the growing-finishing phase of production, although disease can be observed in any age of pig. Pigs exhibit a dry, nonproductive cough that may persist for 1 to 2 months. As the disease spreads from pig to pig in a group, the group may appear to have the disease until slaughter. Pigs infected with only M. hyopneumoniae have normal feed intakes and average daily gains. However, concurrent infection with secondary pathogens result in decreased feed intake and consequently the pigs fail to grow at a normal rate. Variation in the number and identity of the secondary organisms, dose of M. hyopneumoniae organisms and the extent of the pneumonia result in a variable depression of the growth rate in a group of infected pigs.

Clinical signs and lesions of mycoplasmal pneumonia are occasionally observed in nursery age pigs in the presence of PRRSV and other secondary organisms. Pigs will exhibit fever, lethargy, respiratory distress and decreased feed consumption. The percentage of pneumonia in these pigs can be extremely high with greater than 80% of the lungs of an individual pig with lesions of pneumonia, mainly due to potentiation of PRRSV pneumonia by M. hyopneumoniae.

Economic Effect

Although the specific economic effect of mycoplasmal pneumonia can be difficult to determine on a herd basis, a review of a number of studies of herds with enzootic pneumonia found on average a 17% decrease in daily weight gain and a 14% decrease in feed efficiency. In addition, it has been estimated that for every 10% of the lung with pneumonia, the mean daily gain is reduced by 37 grams. One study estimated that the cost per pig for mycoplasmal pneumonia was $4.08, and the annual cost for the entire U.S. swine industry was about $367 million. This study excluded medication costs which can range from none up to $4-5 per pig on a herd basis depending on whether the herd is infected or not, the effectiveness an infected herd’s vaccination program and other contributing factors such as co-infections and production, housing, nutritional and management factors that influence disease severity (see Table 1).

Diagnosis

Diagnosis of mycoplasmal pneumonia remains difficult. Currently, the best results are achieved by clinical observation, postmortem and histological examinations, and fluorescent antibody examination (IFA). Polymerase chain reaction (PCR) assays are increasing in popularity. However, PCR is a very sensitive test and a positive test result only indicates that the animal is infected and not necessarily experiencing mycoplasmal pneumonia. Accordingly, environmental contamination and proper sample collection and handling must be carefully considered when using PCR assays for diagnostic purposes. Isolation of M. hyopneumoniae organisms is slow, difficult and not routinely available. In addition, the laboratory isolating the organism must be able to differentiate M. hyopneumoniae from other common non-disease inducing species of mycoplasmas. Most laboratories would base a positive diagnosis on detecting the organism by PCR or IFA, and identifying characteristic microscopic lesions in lung tissue.
Enzyme linked immuno-sorbent assay (ELISA) is the primary test used for measuring antibodies in serum. Several types of ELISA assays are available so interpretation is test specific. Serology is best used on a herd basis, not for individual animals. ELISA results can aid in supporting a diagnosis of M. hyopneumoniae infection in a herd. However, depending on the ELISA test used, antibodies can be detected in the serum 2-6 weeks after exposure of infected animals, making use of serology a poor measure of timing of infection. Use of molecular typing to assess the genetics of M. hyopneumoniae within or between herds has increased. As more studies are performed, more information on the impact of genetic and antigenic differences will be known. Ultimately, the assay used for M. hyopneumoniae diagnostics depends on the whether the onset of infection status is being determined in order to more accurately time intervention strategies.

Control Measures

Antibiotics- Antibiotics are frequently used to treat pneumonia in pigs. Many antibiotics appear to be effective against M. hyopneumoniae in the laboratory. However, their success in the pig under field conditions is often poor. A recent study found that chlortetracycline administered prior to infection was effective in decreasing both the formation of pneumonia and the number of organisms. Administration of the drug following infection resulted in no reduction in pneumonia; however, the number of organisms was significantly decreased. Studies have investigated tiamulin, either before or after M. hyopneumoniae challenge, and found minimal effect on the clinical signs or lesions of mycoplasmal pneumonia. Lincomycin administered by injection or at high doses in the feed has been useful in reducing the number of organisms in the lungs. When lincomycin was administered with and without M. hyopneumoniae vaccines, it successfully reduced or prevented pneumonia. Other studies have demonstrated the beneficial effects of tilmicosin, tulathromycin and tetracyclines. Several studies have found some isolates demonstrating antibiotic resistance. Many of the antibiotics, such as penicillin and ceftiofur, may enhance growth performance and aid in the control of secondary infections, but have minimal to no effect on the organism due to M. hyopneumoniae’s lack of cell wall. No antibiotics have a significant impact on mycoplasmal pneumonia once established.

Vaccines

A number of commercial vaccines are available which are effective in the control of mycoplasmal pneumonia experimentally and in the field. Mycoplasma vaccines do not prevent infection, but reduce clinical disease and lung lesions. However, vaccine failure under production settings has been reported. Research has shown that the presence of PRRSV during or immediately following M. hyopneumoniae vaccination may decrease vaccine efficacy. Also, the role of antigenic variation between field and vaccine isolates remains unclear. Each production system should determine whether there is a need to use vaccines and the appropriate time to administer them to ensure optimal, economically sound disease control. Vaccination against mycoplasmal pneumonia is often considered an important tool in the control of PRDC and other diseases in many herds. Vaccination is generally considered a better option than antibiotic therapy for the long term control of mycoplasmal pneumonia.

Management

Whenever possible, the farm should incorporate sound management procedures into the production system. Special attention should be given to the factors listed in Table 1 especially the major influences designated with 3 (+) signs.

Elimination of Disease

For many production systems, eradication has become the goal for mycoplasma control. A number of strategies have been successful including medicated early weaning, partial depopulation strategies that involves a piglet and gilt free period of time which are typically about 10 months in duration. Most eradication strategies utilize antibiotics to aid in eliminating the organisms. Re-infection of naïve herds, which can be devastating to the health of sows and the control of respiratory disease on a herd basis, has been reported and strict biosecurity practices must be in place to maintain the health status.

Seed stock suppliers heavily utilize these disease control programs; however, because re-infection of herds free of mycoplasmal pneumonia is common, these programs are less frequently implemented in commercial herds. It is important to know the infection status of incoming animals as introduction of infected animals can be problematic as can the introduction of naïve animals into mycoplasma infected herds as previously discussed.