Field-Based Assessment of the Role of Porcine Cytomegalovirus in Respiratory Disease of Nursery Pigs

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Summary and Implications

Porcine cytomegalovirus (PCMV) is an ubiquitous infectious agent in swine population throughout the world. Field and some experimental observations have suggested that PCMV plays an important role in causing or enhancing respiratory and/or reproductive disease of swine. However, no actual measure of this has been documented. As the first step in assessing the economic significance of PCMV infection for swine herds in the United States, a field-based case-control study was conducted to evaluate the potential role of the virus in respiratory disease of young swine. The data in this study, thus far, suggest that there may be an association between PCMV infection and increased risk of respiratory disease development in nursery pig populations and that, as was expected, PCMV infection is a common finding among nursery pigs. In an era in which multi-factorial respiratory disease and associated decrease in production efficiency is such a large concern, it may be prudent to consider PCMV when developing and implementing strategies for production management and pig flow.

Introduction

Porcine cytomegalovirus, a beta herpes virus, is recognized as the causative agent of inclusion body rhinitis of young swine (1,8). The PCMV has been documented to cause runting, poor weight gain, pneumonia, and rhinitis in nursery age pigs (1). The virus also has been shown to cause reproductive failure when immunologically naïve females are exposed to the virus during pregnancy (2–4).

Porcine cytomegalovirus is ubiquitous in swine-producing regions throughout the world and is thought to be immunosuppressive (6–8,10). Persistence of virus infection in a cycle of latency and recrudescence under stressful conditions is considered to be ongoing problem in affected herds (1–3,5).

Results of virological and serological surveys of swine herds in the United Kingdom suggested that PCMV is a significant respiratory disease pathogen (11). Canadian investigators have suggested that PCMV is emerging as an economically significant pathogen for swine herds with minimal disease status (9). However, the economic importance of PCMV infection in United States swine herds is, for the most part, unknown. Among practicing veterinarians, PCMV is generally perceived to be relatively insignificant. Definitive diagnosis of PCMV has been difficult and is not consistently pursued. In addition, the clinical signs associated with PCMV infection are at times indistinguishable from those caused by porcine reproductive and respiratory syndrome virus infection (7,12).

Although field observations and limited experimental data have suggested that PCMV plays a significant role in causing and/or complicating respiratory disease, to date no actual measure of that role has been documented in the literature. All of these factors work synergistically to leave the picture of clinical significance unclear. To more clearly focus this picture a field-based study was proposed to assess the role of PCMV in nursery pigs with clinical respiratory disease.

Materials and Methods

Experimental design. A case-control study was conducted in which cases were defined as nursery pigs with clinical respiratory disease. Nursery pigs with no signs of clinical respiratory disease served as controls. To achieve a broader perspective a maximum number of three animals, either cases or controls, were to be taken from any one herd. Cases and controls were collected from submissions to the Iowa State University Veterinary Diagnostic Laboratory. Some controls were collected during herd visits in the field. Although approximately 100 cases and 150–200 controls were planned to collect, at the time of this report, 56 (n) nursery pigs have been collected as either case or control. Nasal swabs and/or nasal turbinates were taken from each pig and assayed for the presence of PCMV by the virus isolation technique described below. Results were statistically analyzed by Chi-square test to determine if PCMV infection contributes to respiratory disease.

Virus detection. The presence of PCMV in biological samples collected from animals was determined by a modified centrifugal virus isolation (VI) procedure. Processing and inoculation of samples was done by one of the following two methods: (1) homogenization (10% wt/vol) of nasal turbinate followed by filtered inoculation onto porcine alveolar macrophages (PAMs) cultures prepared in 48-well plates 24 hours earlier or (2) expression of nasal swabs in balanced salt solution followed by filtered inoculation onto PAM cultures prepared in an identical manner to those described above. After inoculation, plates containing inoculated and control PAMs were centrifuged for 10 minutes at 1,000 x *g*. Cultures were then allowed to incubate for 10 days in a water-jacketed 37°C humidified incubator with a 5% carbon dioxide atmosphere. At the end of the incubation period, an indirect immunofluorescent

antibody assay was carried out to visualize and confirm the presence of PCMV in inoculated cells. This was accomplished using polyclonal porcine antiserum monospecific for PCMV. Stained cultures were then examined under a fluorescing microscope to detect the presence of PCMV.

Results and Discussion

Virus isolation results are summarized in the Table 1. Based upon the number of animals available by the time of this report, no significant difference in the isolation rate of PCMV between cases and controls was found at 95% confidence level. However, it is interesting to note that 50% of the cases were positive for PCMV by VI and that 65% of the animals that were VI positive for PCMV had developed respiratory disease. In contrast, only 31% of the controls were PCMV positive upon VI and only 45% of the PCMV-negative animals had developed respiratory disease. Statistical analysis also suggested that PCMV-positive pigs are at higher risk for respiratory disease, twice much as PCMV-negative pigs (odd ratio=2.25). We find that if this trend remains consistent with the observed data, statistical significance can be demonstrated with a sample size of as little as 2n (=112), which is far less than the number initially planned to collect. To further explore this trend expansion of this case-control study to a sample size greater than or equal to 2n is under way.

At present little is known about the role that PCMV plays in respiratory disease of young swine. Even less is known about the economic significance of PCMV infection. As we strive to reach the next plateau of herd health and of production efficiency we must focus on factors once ignored. PCMV may be one of these factors.

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Table 1.Comparison of PCMV isolation in nursery pigs with and without respiratory disease.

	PCMV positive	PCMV negative	Total
Pigs with respiratory disease (cases)	15	15	30
Pigs without respiratory disease (controls)	8	18	26
Total	23	33	56