

# Porcine Circovirus Update

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## ▪ Introduction

Circoviruses are a family of small DNA viruses that infect several animal species. Two avian circoviruses that cause disease in birds, chicken anemia virus and psittacine beak and feather disease virus, have been studied by veterinary researchers for several years. These viruses do not infect pigs.

## ▪ Identification of Porcine Circovirus

In 1974, a swine circovirus (porcine circovirus-PCV) was isolated from a line of swine kidney cells used for laboratory research purposes. This particular strain of PCV was identified as porcine circovirus type 1 (PCV-1) and has been thoroughly studied and investigated since its discovery. To this date, researchers have not been able to establish any clinical significance to PCV-1; we have not been able to prove it is responsible for causing disease in swine. Serological surveys (blood tests) for PCV-1 indicate the virus is widespread throughout swine herds and most pigs have been exposed. How PCV-1 spreads throughout the swine population and when pigs become infected etc. is not known at this time.

Another distinct swine porcine circovirus (PCV-2) was identified by researchers at the University of Saskatchewan (Clark, Ellis, Harding, West) in the mid 1990's in "association" with a new and distinct health problem of pigs called PMWS (post-weaning multi-systemic wasting syndrome). By 1997 their work was beginning to establish with some certainty that PCV-2 was capable of causing PMWS and in 1999 researchers were able confirm this earlier suspicion. Currently researchers from several different laboratories have demonstrated that PCV-2 is a distinct virus (genetically and antigenically) of pigs responsible for PMWS. There is some evidence that PCV-2 may be involved with several other swine health problems as well.

## ▪ **Epidemiology**

PMWS was first reported in western Canada in 1991 and through the 1990's the number and frequency of diagnosis increased. As of 2000, it has been reported across Canada, United States, and in many European (France, Spain, United Kingdom, Italy, Netherlands, Germany) and Asian countries. It is now seen as one of the most significant health problems in nursery and feeder pigs.

## ▪ **Clinical Signs**

The strongest evidence for PCV-2 involvement in swine disease is PMWS. This syndrome is seen primarily in pigs between 5 to 18 weeks of age. Clinically it is characterized by "wasting" - pigs that fail to grow at the same rate as their penmates, then start to loose weight, eventually becoming extremely thin and emaciated. They may show signs of pneumonia and/or diarrhea. They are non-responsive to antibiotic therapy and, in spite of good treatment and extra care, continue to loose weight.

## ▪ **Diagnosis**

On post-mortem examination, these pigs are emaciated, many have stomach ulcers, and commonly there are signs of severe inflammation and/or degeneration in lung, kidney, liver and lymphoid tissue. The microscopic changes seen in tissues are usually considered diagnostic for this condition but there are special laboratory tests available to confirm a diagnosis of PVC-2 infection should they be needed. *A complete veterinary examination of live and necropsied pigs is necessary to confirm a PMWS diagnosis as there are other causes of unthrifty pigs in nursery and feeder barns that need to be differentiated from PMWS.*

The presence of PMWS varies tremendously from herd to herd; some herds appear to be disease free while in most herds that have had a positive case the number of pigs affected would be between 1 and 5%. In the few "outbreaks" that have been recorded, up to 50% of the pigs show symptoms and there is significantly elevated mortality.

## ▪ **Prevention and Control**

We do not understand why PMWS has become a recent health challenge to our swine herds. Through laboratory tests we know the virus has been around for years and that most pigs have been exposed to it. Is the development of

PMWS related to changes in management that have occurred in the last decade or has there been a change in the ability of the virus to cause disease? The answers to these questions remain unknown. It is my opinion and I believe that of many swine veterinarians, that “stress” is a significant factor in initiating the development of this disease in pigs. Concurrent disease stress, nutritional stress, environmental stress, crowding, early weaning, poor sanitation, mixing pigs excessively, all can be factors that impact the development of this problem. What is the best plan to control and reduce PMWS- at this time we only recommend minimizing stress on the pigs where possible. There is no magic bullet available to control this challenge – no vaccine, no medication or other treatment - PMWS is reduced but not eliminated when we grow the pigs at the highest level of management possible and it will flare up if our management fails.

Another question that requires more research is - *How does infection with PCV-2 cause PMWS?* Some current studies suggest that when the immune system becomes activated fighting off a disease challenge and the pig also is infected with PCV-2, the circovirus infection may become overwhelming and result in PMWS. That many PCV-2 infections are co-infections with other pathogens also gives support to this idea.

There are several other conditions that have been associated with PCV-2 infection: reproductive failure, proliferative necrotizing pneumonia, porcine dermatitis nephropathy syndrome, post-weaning PRRS and congenital tremors. It is very important to recognize that to date veterinary researchers have not been able to prove PCV-2 infection alone or in combination with other infectious agents as the cause of these associated syndromes. In these cases PCV-2 has been found associated with microscopic abnormalities found in the tissues. However, often there are other concurrent infections evident, i.e. Parvo virus (reproductive failure), swine influenza virus (PNP), or PRRS virus.

The reproductive failure syndrome which has been observed in several gilt start-up herds is characterized by elevated numbers of late term aborted piglets, mummified piglets, stillborn piglets, and weakborn piglets. Postmortem examination of piglets reveals abnormalities associated with congestive heart failure- excess fluid in the chest and abdominal cavities, enlarged irregular hearts and on microscopic examination damaged heart muscle cells which in many areas have been replaced with scar tissue. Special tests (immunohistochemistry) reveals infection of heart muscle cells with PCV-2 virus. In the herd that I observed PCV-2 associated reproductive failure, a concurrent Parvovirus infection was diagnosed as well and research has shown that animals with both infections are more likely to show signs of reproductive disease. Because this syndrome of reproductive failure has been observed in gilt herds that have been raised in strict isolation it seems likely our management practices are contributing to this problem.

## ▪ **Conclusion**

In summary, PCV-2 infection has been demonstrated to cause PMWS. Its relationship to the other conditions mentioned remains interesting but unproven. Through ongoing veterinary research we will gain a better understanding of the role of this infectious agent in PMWS and the other conditions mentioned.