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Porcine Circovirus Associated Disease: Control

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Introduction

Six main strategies or approaches have shown some value in the control of Porcine Circovirus Associated Disease (PCVAD): depopulation and repopulation, serotherapy, management and nutritional changes, the control of concomitant diseases that are aggravating the condition, genetics, and finally, vaccines.

Depopulation and Repopulation

Hassing et al [1] reported that of six Danish herds that were depopulated, cleaned, disinfected and left emptied for 3-4 weeks, then repopulated with animals from herds without PCVAD, five got rid of the problem. In the sixth herd it reappeared about three months after the repopulation program, but in that case the supplier of pigs was the same as before the depopulation/repopulation. Gresham et al [2] also reported that PCVAD had not recurred in three farms after complete depopulation and re-stocking with pigs from unaffected farms. Thus successes in the control of PCVAD have been obtained in the past with depopulation/repopulation, and it could constitute an alternative. It should be kept in mind however that since we still don't fully understand the epidemiology of the condition, and the ways by which it can become a problem, caution should be exercised when deciding to make a costly decision such as depopulation and repopulation. We had very few herds in Quebec with significant PCVAD problems before late 2004; we have had many since then and we're still not sure why. Furthermore some of the control options that are available today are much more effective than what we could rely upon in the past.

Serotherapy

Ferreira et al [3] were the first to propose serotherapy as an alternative to prevent losses associated with PCVAD. Piglets that were about 33 days of age were injected subcutaneously with 20 mL of serum from pigs ready for market that had gone through the problem and had recovered. The results obtained in three trials were excellent (15.2% vs. 4.9%; 18.5% vs. 2.7%; 17.9% vs. 2.8% mortality). Different variations of this strategy, in most cases using lower volumes of serum, have been used successfully in other countries like Spain, UK, the Czech Republic and Canada. But the procedure is not easily applied, there are risks associated with it and except for a few particular situations, the results obtained overall in Quebec have not met expectations. At the very least, producers considering this procedure should consult a veterinarian.

Control of other Diseases

Other diseases, PRRS in particular, can either trigger PCVAD problems or make them worse. The mortality rate in PRRS-negative herds does not often exceed 10 or 15%, but there are cases where mortality was 50% or more in PRRS-positive herds. Furthermore, in some experimental infections the losses were much higher when both PCV2 and PRRS virus were inoculated, compared to either virus given alone [4,5]. Thus it is important to try controlling all infections that could potentially make things worse, and this includes, among others, enzootic pneumonia and swine influenza. The same could possibly be said about parvovirus if it was found circulating concurrently with PCV2.

Management and Nutritional Changes

As for most other diseases the quality of management can help to prevent or reduce the negative impact of PCVAD. A French scientist, Dr. François Madec, has proposed a list of 20 rules which, when followed, have reduced the severity of losses in a number of herds [6]:

Farrowing room

- Emptying of pit, cleaning, disinfection; wash sows and treat for parasites; adoptions: limit cross fostering to what is strictly necessary and only within 24 hours of farrowing; observe parity rank; conformity of vaccination plans

Nursery

- Small nursery pens, solid partitions; empty pit, clean, wash and disinfect; lower stocking density (3 pigs/m2); increased feeder space (7 cm/pig); perfect ventilation; perfect temperature; no mixing of batches (1 batch per room)

Finishing

- Small pens with solid partitions in finishing; empty pit, wash and disinfect; 0.75 m2/pig (8.1 sq feet/pig); temperature, ventilation: OK; no mixing of pens; no mixing of batches

Other measures

- Respect flow of air and animals within buildings; strict hygiene (tail and teeth clipping, castration, injections…); early removal of sick pigs to hospital pens

As can be seen, many of the measures proposed are basically applying good husbandry practices, and as for some of the others they would be difficult to implement in many of the North American systems (e.g. multi-site systems). Nevertheless, it is believed in France that the more of these rules are applied the greater are the chances that losses associated with PCVAD will be reduced. Besides, there are examples suggesting that management may play a significant role in the expression of the disease. For example, Boivent et al [7] reported that the same sow herd was sending piglets to two different weaning-to-finish operations, and for about a year, one had major problems with PCVAD while the other had none.

Lots of other management and nutritional strategies have been suggested by different authors to help control PCVAD. These include: reduce the number of weaned or feeder pig sources; reevaluate the vaccines and vaccination programs used; use disinfectants (e.g., mixture of peroxymonosulfate and sodium chloride) that have good activity against PCV2; batch farrowing every 2, 3, 4 or even 5 weeks; partial depopulation of the nursery; bioflavonoids, vitamin E and Selenium, antioxidants, mash feed, feeds with larger particle size, restricted feeding, no feed changes after moving pigs, richer diets; no hospital pens, either euthanize sick pigs or move them elsewhere; increase weaning age; various anti-inflammatory and antimicrobial products; vaccination against porcine parvovirus and erysipelas; closing the herd; use measures to improve colostrum intake; all piglets to suckle their natural mothers for the first 24 hours. The list seems almost endless and one must admit that the results obtained have been very variable, and quite frequently disappointing. Recently, some positive results have been obtained in Brazil and Canada when spray dried plasma was given in the feed just before the time when pigs were getting sick.

Genetic Changes

There seems to be little doubt that genetics can have a significant impact on this condition. Here are some findings that tend to substantiate that assertion:

- In a herd with both Landrace and Large White animals, the former were significantly more affected with PCVAD clinically than the latter. Since these animals are in the same herd and buildings, environmental, management, nutritional and microbial factors are the same, so genetics appears to play a role in this particular case. [Harding J, personal communication, 2005]

- Opriessnig et al [8] experimentally infected Duroc (23), Landrace (19) and Large White (21) pigs with PCV2 at 5-7 weeks of age. One Landrace pig developed PCVAD and two others had characteristic gross and microscopic lesions of the condition. No pigs of the other two breeds showed clinical signs or gross lesions of PCVAD. The authors concluded their results suggested that the Landrace pigs were predisposed to PCV2-associated lymphoid depletion and PCVAD.

- Lopez-Soria et al [9] reported the results of a comparison between the progeny of three different boar genetics (Pietrain, Large White (50%)/Pietrain (50%), and Large White (25%)/Duroc (75%) from 2 large 5000 sow Spanish herds. The sows were of the same genetic background for all three genetics of boars used. In pigs from the two sow farms, the total mortality rate and the mortality rate specifically associated with PCVAD were, for the three different boar genetics, respectively 1.8 and 1.1%, 5.4 and 2.7%, and 16.3 and 12.4%.

- A similar experiment was conducted by Boivent et al [7] in Brittany, France. For about a year a herd had a high weaning to slaughter mortality (11%) associated to PCVAD. Sows were either inseminated with semen from purebred Pietrain boars or from Large White (50%)/Pietrain (50%) boars. Two batches of pigs were compared. Globally, the mortality rate in pigs from the Pietrain boars was 3.9% while it was 12.9% in those from the Large White/Pietrain boars.

- Belgium is surrounded by countries (France, Germany and The Netherlands) that have been hit hard with PCVAD. Yet this small country did not have a significant PCVAD problem in the past, and still doesn't. Why is it then that of all the countries in South-Western Europe, only this one seems to have avoided the major pain and suffering associated with PCVAD? Nobody knows for sure, but one of the possible explanations could be that the vast majority of producers in that country use Pietrain boars and these lines of Pietrain may produce a more resistant progeny.

- Not all information on the Pietrain breed shows positive results in regards to a relative PCVAD resistance. In a study conducted by Rose et al [10] in four French farms, no beneficial effect of the Pietrain boars against PCVAD could be detected in their progeny. Similarly results obtained so far in Quebec and the US with a certain line of that breed have not improved the situation compared to the previous breed of boars used, indicating that either this boar line does not allow an increased resistance against the condition, or that the genetic combination (that particular boar line with that specific sow line) used does not result in improved resistance.

- Two herds in Northern Ireland observed a sharp decrease in mortality (7.9 to 0.9% in one herd and between 4 and 10 to less than 2% in the other) when a switch in boar line was made. Two experiments were conducted in that country with the genetic line that appeared to be more resistant in the field. The experimental model used infection with both PCV2 and parvovirus and had been very successful in consistently reproducing the condition in the past. While these experiments are very preliminary and will need to be confirmed in a more complete study, none of the pigs developed PCVAD, suggesting that this genetic of pigs may have a relative resistance against the disease (Allan G, personal communication, 2006).

- In the Netherlands, an epidemiological study involving herds with and without PCVAD and PDNS found an association between PCVAD/PDNS and the historical use of breeding stock from an Anglo-Saxon origin [11].

- At the July 2006, IPVS meeting, Bergström et al [12] reported that purebred animals from different herds were raised in a Swedish progeny testing station. PCVAD became a problem and the proportion of animals that were found to be thin or wasted was 2.8% for the Hampshire, 8.8% for the Yorkshire, 11.3% for the Landrace and 11.7% for the SPF-Yorkshire animals. The authors concluded that under the conditions of their study, Hampshire pigs were less likely to become thin or wasted. Information from UK also suggests that some genetic lines of the Hampshire breed may offer some resistance against the disease.

- Two Canadian companies had significant problems with PCVAD. Pigs from the same sow genetics but from two different boar genetics were raised together in some finishing units. In both cases losses were reduced by about half in the progeny of one boar genetics (Moore C, personal communication, 2006; Bellavance M, personal communication, 2006). In yet a third company, this time in the US, the same boars that appeared to have a relative protective effect in some Canadian herds were used in matings with females of a different sow line. The pigs produced from this different genetic combination suffered severe losses associated with PCVAD (Jones R, personal communication, 2006).

- In Canada again a company used different genetic lines and over time it appeared that there were variations in the susceptibility of pigs to PCVAD depending on their genetic composition. One particular genetic line seemed to be much less susceptible to PMWS problems than others (Surprenant C, personal communication, 2006). Testimonials from veterinary colleagues of five other countries concerning that genetic line go in the same direction. So this particular line of pigs seems to have a relative resistance to the condition, or to be less susceptible to it.

- It is possible that even within the same breed there might be differences in the relative susceptibility or resistance to that condition. Table 1 shows the mortality of pigs born from two different Duroc boar lines, but from the same sow line, within the same system, before and after PCVAD became a problem (Turner M, personal communication, 2006). As can be seen, the progeny from one genetic line within the Duroc breed appeared to be much less affected with PCVAD than the other. While the mortality of progeny from line A was increased by only 0.5% after PCVAD became a problem, it was increased by 4% in the progeny of line B. Interestingly, there was a 1% mortality difference between the two lines even before the PCVAD problems, suggesting a genetic difference on the mortality associated to causes other than that condition.

Table 1: Mortality in finishing units in the progeny of two different Duroc boar lines

Period	**Morality**	
	Duroc A	Duroc B
Jan-June 2005 (before PCVAD)	2.5 % (245,945)*	3.5 % (316,297)
Jan-Apr 2006 (with PCVAD)	3.0 % (29,504)	3.0 % (29,504)

* Number of pigs included

What comes out is that different breeds, genetic lines or genetic combinations (a specific boar line with a specific sow line) may have a vastly different resistance to PCVAD. There could even be differences within the same breed. At this time preliminary information suggests that the Landrace breed, or some Landrace lines could have an increased susceptibility, and that the Pietrain and Hampshire breeds, or some specific lines of these breeds could have an increased resistance to PCVAD. But this again is very preliminary, and since the data on the relative resistance of certain genetics are not all going in the same direction, and since other criteria have to be considered in the choice of breeders, care should be taken before making changes. However genetics remains one of the control options to consider, particularly in situations where there is no access to efficient vaccines and little hope of getting these vaccines in a near future.

Vaccines

A PCV2 vaccine for use in sows and gilts has been available in France and Germany for about two years. In one study from the former country, the average weaning to slaughter mortality rate dropped from 11.0% to 7.7% in 15 herds where the vaccine was used [13]. In the second country the birth to slaughter mortality rate in 38 herds where the vaccine was used dropped from 28.7% to 17.9% [14]. In each of these studies the results were compared before and after the use of the vaccine, so it could be that in some herds the performance might have improved even in the absence of vaccination. Nevertheless, the information received from different French practitioners suggests that in France the vaccine can be useful to prevent losses associated with PCVAD. This vaccine has also been available in Canada since the spring of 2006. There seems to be three main different outcomes associated with the use of this sow vaccine in this country. In some cases the problems are either solved or much improved. In others the losses are either only slightly improved, or not at all. Finally, there are cases where problems that used to occur at a given age are not occurring at that age anymore, but are occurring later. These results though are preliminary and more time will be needed to properly assess the value of this product.

Results obtained in Canada and the US with inactivated PCV2 vaccines designed for use in young pigs suggest that these vaccines are very efficacious. Three commercial pig vaccines are presently available in the US. One of them is a two dose, 2 mL product; another one is a one dose, 2 mL product and the last one is a one dose, 1 mL product. The field information gathered to date indicates that PCVAD losses following the use of these vaccines have been reduced in some cases, and totally eliminated in others. In one particular study involving 4 different finishing units, piglets that had been vaccinated with a 1 mL one dose product had a mortality of 2.4%, while the non vaccinated pigs in the same barns were at 9.5%.
A question often asked is which type of vaccine appears to give the best results, the sow vaccine, or the pig vaccines. Looking at efficacy per se, up to now it looks as if pig vaccines would clearly have an edge. The general opinion of field practitioners is that the protection seems to be more complete, more frequently. At the time of writing some of the vaccines available were in short supply and could not totally cover the demand.

Summary

PCVAD has produced severe losses for pig producers in many areas of the world. While North America has to a certain extent avoided significant problems until recently, losses associated with it have become unacceptably high in the last two years for many systems, and solutions had to be found. Different control alternatives have been briefly discussed in this paper. Depending on the circumstances, the value of these alternatives will vary. Two approaches that seem to be of particular interest for a practical control of that condition are genetics and vaccines. Some genetic lines or combinations are clearly more resistant to PCVAD than others, and the preliminary results obtained with vaccines are conclusive. In fact, an effective and practical control of the problems associated with PCV2 now appears possible.

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