Postweaning Multisystemic Wasting Syndrome
Control and treatment strategies

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Once a diagnosis of herd Post-weaning Multisystemic Wasting Syndrome (PMWS) is made, (which can be difficult), a control and treatment programme of enhanced management must be immediately implemented. This programme is likely to be more intense than anything the farm health team has ever undertaken previously.
As the causal agent of PMWS is not yet recognized, control has to be non-specific. The PMWS disease agent acts on other agents – specifically recognized is Porcine Circovirus 2 (PCV2) which contributes to the pathogenesis of the disease. Other possible agents are beginning to be recognized; among these are the Torque Teno viruses and possible Toro viruses. Even the role of PCV2 is becoming more complicated with 3 strains being recognized (PCV2a,b and c). The use of vaccines to PCV2 has proven to dramatically control the clinical signs of PMWS and while the PCV2 vaccines originate from PCV2a strains it appears to be protective against PMWS associated with the other strains. This is interesting as the natural presence of these viruses and their antibodies on a farm are not protective.

The majority of farms, (if not all commercial farms) are positive to PCV2 – this includes farms in Australia which has not imported live pigs since 1992 but which remains PMWS free. The presence of PCV2 makes no impact on the spread of "epidemic" PMWS. This disease appears to move as a novel agent entering a population of pigs – either as a yet unrecognised novel PCV2 agent or an as yet unrecognized agent. The evidence that the current strains are either more or less pathogenic from each other is still under investigation, but early indications are of no significant differences. There are examples of population of pigs free of PCV2 – but these are extremely isolated island populations with no contact with "mainland" commercial pig farming enterprises.
The condition "epidemic" PMWS was first recognized in France in 1994 and has since spread throughout Northern Europe into Asia in 2000. In late 2004 the condition crossed into North America and has now spread by 2008 into Chile. It should be noted that the term PMWS was first coined to describe a condition seen in Canada in 1991, however, this condition disappeared from the farm within a year and its clinical symptoms are not consistent with "epidemic" PMWS later described around the world.

PMWS free farm

If the farm (or area/country) believes it is free of PMWS, the farm should attempt to do everything and anything to minimize any risk of introduction. Note the farm is not going to be free of PCV2 and individual lymph nodes and animals may present with histological signs characteristic of PCV2 infection.

The causal agent of PMWS is transmitted between farms by two main routes

Locality

The disease/syndrome has spread to closed units with high biosecurity that were within 2km from a newly affected farm. On two occasions the next farm became clinical within 4 months.

Pig to pig movement

Pig to Pig movement is the premier source of infection. The movement of semen and gilts (or boars) from an infected farm has resulted in a spread of the clinical signs of PMWS.

Farms, which have purchased semen and gilts from breeding farms, that demonstrated no clinical signs, have remained negative – after 5 years of monitoring.
If a farm is free of clinical PMWS ensure that the genetic source is also free. Alternatively on-farm AI collection and raising homebred gilts should be practiced.

Other routes
Until the causal agent is known, the spread of PMWS cannot be predicted.
However, avoid:
Movement of unclean buildings/equipment – wooden weaner shelters were purchased from a clinically affected unit and moved to an isolated clean unit. The clean unit then demonstrated clinical signs within 2 months.
Repopulation into a poorly cleaned farm, which was depopulated because of severe clinical signs. The unit was not thoroughly cleaned with clear evidence of faeces remained in the pens. The clinical signs of PMWS were seen in the first batch of weaners produced.

PMWS infected farm – Control

There are four long term control strategies:

Depopulation and repopulation
Elimination of PMWS can be effected through depopulation and repopulation. But note the repopulation must be from a PMWS negative herd, this claim is difficult to substantiate. However, if such a farm can be found and suitable breeding stock acquired then depopulation, along with extensive thorough cleaning and a downtime of 4 weeks and repopulation may result in the production of a PMWS negative herd. Note the presence and prevalence of PCV2 will not be affected.

Repopulation has produced clinically negative pigs for over 6 years in the UK (in a 200 sow unit). The size of the unit is not necessarily prohibitive as depopulation and repopulation has eliminated PMWS on a 2000 sow unit.

Repopulation has failed for three reasons

1. Poor/inadequate cleaning – all feaces were not removed during cleaning
2. Introduction of poorly cleaned second hand accommodation from a PMWS positive farm
3. Change of genetics to a PMWS positive source – via the introduction of AI semen or gilts.

Farms who have successfully controlled PMWS to acceptable levels
After several years of fighting PMWS in Northern Europe farm heath teams have become proficient at managing the clinical effects of PMWS. The condition clinically affects only small numbers of animals and post-weaning mortality can be controlled to 4-5%. Eventually the levels will stablise at about 1.5x the previous “normal” post-weaning mortality. – but it is rare to achieve levels below pre-infection with PMWS. The fewer serious pathogens present the easier it is to restore reasonable health. The continued sub-clinical effects of PMWS are difficult to estimate. Vaccine trials using PCV2 indicate that improvement in growth rates can be achieved averaging about 30g/day even on clinically negative units.
Unfortunately, even though the clinical signs may be subdued, if major management production failures occur, clinical PMWS can rapidly reappear accompanied by horrendous post-weaning mortality and morbidity. Examples of such management failings have been associated with: a change in the manager; social disagreements between staff, a farm fire overstocking of the grower herd associated with poor breeding management (pig flow) and introduction of Porcine Reproductive and Respiratory Syndrome Virus (PRRSv).

Enhancing immunity on farm

Vaccines towards PCV2 have proved to be exceptionally effective in controlling clinical signs of PMWS and possibly other PCV associated diseases.

Currently all vaccines are inactive and range from whole virus, subunit vaccines to the ORF 2 protein or a chimera of PCV1 and PCV2.

There are two major vaccination strategies:

Vaccine to the mother (sow and gilt) pre-farrowing.

This confirms enhanced antibody immunity to the piglet through colostrum. The maternal acquired immunity is enhanced and is maintained beyond the normal 3 weeks to cover the weaner through the immediate post-weaning infection phase. It has been recognized that piglets born to mothers with low immunity of PCV2 have lower colostrum antibody levels and appear to suffer clinical PMWS at a higher rate – thus creating a litter effect. Vaccination of the mother can be extremely effective at reducing the clinical signs of PMWS in the weaner/grower phase, but there is evidence that (some of) the pigs are not protected into the finishing phase, although the clinical signs are ameliorated. However, the success of this vaccine regime relies on good colostral transfer – thus excellent farrowing management.

Vaccine to the weaner – before 5 weeks of age

These vaccines are again extremely effective at protecting the weaner to finisher from clinical signs of PMWS. In addition they have been demonstrated to reduce the variability between pigs and enhance the growth rates of vaccinated pigs – over the control unvaccinated animals. However, the vaccine need to be administered to all piglets which can be a time consuming and frustrating enterprise. This will be made easier by the development of multivalent vaccines – for both *Mycoplasma hyopneumoniae* and PCV2 for example.

There is little difference being reported between the different vaccine types

As a general summary (meta-analysis IPVS 2008 papers)

	Post-weaning mortality %		**Difference in growth rates**
	Range	**Average**	
Vaccinated	2-8%	4.5%	+ 30g/day
Unvaccinated	30-6%	9.1% (30% case omitted)	

Papers reviewed IPVS 2008– P01:037,38,73,77,82,90,94,102,103,105 and OR01:25,37,46.

Enhancing immunity by autogenous methods

Serum therapy and autogenous vaccines

Serum therapy became popular in Europe however, while effective at reducing mortality in the 15 - 40kg pigs. Unfortunately it proved only to move the mortality problems to a heavier weight at 50+kg, which was more expensive on the farm output. This practice has subsequently stopped. With the development of the PCV2 vaccines, if they can be obtained the use of serum therapy is unwarranted.

Autogenous vaccines can also be manufactured from tissues from infected weaners and growers. The best materials to use are lymph nodes, spleen and tonsils. Do not just use the enlarged lymph nodes.

It should be emphasized that autogenous vaccines are from one particular farm and must be used only on that one farm. If there is any risk of spread of diseases such as Classical Swine Fever or Foot and Mouth, this practice must stop immediately. Materials must never be moved between farms.

Use of feedback

Feedback appears to offer little protection towards PMWS. This is possibly because materials normally used for feedback – placenta/stillborns and post-weaning piglet faeces will have low or negative PCV2 loads. It also does not appear to protect against other agents involved in PMWS. Intentional inoculation of gilts using autogenous vaccines from tonsilar scrape should be considered. Feed back programmes should be maintained to control other background disorders.

On-farm management changes

To reduce the clinical impact, the farmer must minimize all the "stressors" on to a pig, especially during the eight-week period from 8 to 16 weeks of age (15 - 60kg). This can be termed the 8-week "bubble of health".

PMWS temporarily destroys the pig's ability to fight against any pathogen or potential pathogens by destroying the B lymphocytes in the lymph nodes. These B lymphocytes produce antibodies, which are a key component of the body's natural defense mechanisms. The pig will recover because the stem cells of B lymphocytes in the bone marrow are not affected by PMWS and these replenish the killed cells. But this process takes 4 to 6 weeks. The key to fighting this disease is fourfold:

Minimize the stress on the animal to support its failing immune system
Reduce the numbers of pathogens the pig has to fight with its failing immune system
Enhance the pig's immune system so it recovers its immune system as soon as possible
Enhance the immunity to PCV2 prior to the onset of clinical signs.

Biosecurity

External biosecurity

Biosecurity is vital to reduce the introduction of new pathogens to the sick farm. It is essential that farmers avoid making any mistake such as moving dirty equipment from one unit to another. This must include vehicle transport between farm and especially the slaughterhouse. In Europe salmonella outbreaks crippled farms weakened with PMWS.

While PMWS is an extremely important disease, the producer must not forget that PRRSv, Classical Swine Fever, Foot and Mouth Disease *et cetera* will only complicate issues and if the vaccines towards PMWS work, our traditional enemies will still be there to haunt us.

Internal biosecurity

Enhance internal biosecurity through the thorough cleaning of buildings to minimize pathogen build up. The background "bugs" will increase when the previous batch of pigs has suffered PMWS. With inadequate cleaning this occurs batch after batch. The buildings and facilities will become progressively more "pig sick". Stringent cleaning programmes must be adopted.

Note that all-in/all-out should include not only moving the pigs but also cleaning the water supplies, feeders, air and ventilation equipment, floor surfaces and finally medicines, especially needles and syringes.

An essential component of all-in/all-out is that the building is fully prepared for the next group of pigs. For example, ensure that the room is warmed for nursery pigs and that the drinkers are at the right height. It is no longer good enough to correct these faults a week after placement.

Pig Flow

It is only through a thorough examination of the pig business can all-in/all-out be achieved. Adequate floor space can only be achieved by setting and achieving control of the breeding target in every batch of pigs.

All-in/all-out must start in the farrowing area. An age spread of more than 7 days at weaning must be avoided and rooms must be filled in one day. Farms have to radically rethink their flow models to survive. Many moved to a 3 week batching with 4 week (24 day average) weaned pig before they reached the necessary all-in/all-out protocols that provide them with even batches and clean buildings.
All-in/all-out does not occur when a nursery is filled over 3 batches of pigs or from 3 different sources.


Pigs of variable age being mixed. This should not happen with PMWS affected pigs

Experience indicates that provision of 4-week-old weaners does not confer immunity to PMWS, but it does provide for a bigger piglet at weaning, which survives weaning easier.
Weaning pigs older than 5 weeks of age appears to resolve PMWS clinical signs on a number of farms. However, such extreme management changes need to be approached with caution – especially the impact on the farms business plan.

Stock management

It may be necessary to consider some other options regarding management of the pig themselves.

a. **Streaming** – Consider not placing the poorest 10% of pigs into the nursery at weaning. These weaker animals require additional care and a different nutrition from the 90% other pigs. These pigs are not to be re-introduced to their peers. For this to work adequately, these pigs are placed in separate accommodation.
b. Hospital pens – care of the compromised pig. When the clinical signs of PMWS start remove affected pigs to a suitable hospital pen and provide a more comfortable environment and TLC (tender loving care). The removal of these compromised pigs from the rest of the group will reduce the spread of any disease agents.
c. Treatment regime – Adopt a 7 and 14 day rule to compromised pigs. Antibiotics will not stop PMWS but are essential to treatment of secondary infections. Pigs, which survive the 8 week immunological weakness period, will finish, although some will be permanently stunted.
d. Hybrid vigor – Discuss with your genetic supplier the possibility of enhancing hybrid vigor with different boar lines.
Pietrain and Canadian Hampshire pigs have been used in boar lines to good effect in Europe; on many farms the Large White (Yorkshire) purebred boar or others the Duroc produced the highest mortality. But the breed effect both negative and positive can be very “strain” of pig specific.


Hampshire

Obviously this may be a limited option in Australia given the need to keep out other pathogens such as Porcine Reproductive and Respiratory Syndrome Virus, Swine Influenza, Coronaviruses etc.
e. Weaner growth rates – Attention to detail in the first 3 days post-weaning. Weaners need to be trained how to eat, drink, defecate and sleep as individuals to cope with modern post-weaning environments.

Environmental management

This can be divided into four categories: water, feed, floor and the air. Management of the environment is specifically aimed at reducing stress.

Water supplies

All drinkers need to work as recommended by their manufacturer. Pigs must not have to fight over the drinking supply. Ensure the water quality is excellent and aim to reduce excess minerals in the water. Bacterial loads should be minimized. The use of water sanitizers has proven extremely beneficial. The position of the drinkers must be placed away from the sleeping area.

Feed

Feeder management

The feeders need to be managed to minimize fighting over feeder space. When considering the maximum number of pigs per pen, ensure finishing pigs have access to 7 cm of feeder per finishing pig.

Mycotoxins

It is vital to minimize the effects of mycotoxins in the feed. Many mycotoxins have a negative effect on the immune system.

Routine cleaning and removal of all mouldy feed from feed bins and feed lines is an essential part of the farms all-in/all-out programme.

Feed quality

Bird and rodent contamination of the feed

Reduce feacal contamination of feed from birds and rodents by clearing up spilt feed, bird proofing the building, and covering the feeders. Rodent control needs to be well maintained with a 1 metre open walkway around each building.

Feed ingredients

Enhance the immune system through nutritional supplementation. Most of the nutritional supplements aim to increase available anti-oxidants. Vitamin E and Selenium supplementation are known to enhance the immune system, especially in the weaned pig.

Vitamin C is not usually required by the pig, as it makes it own, but in some cases increasing Vitamin C in the feed has been beneficial to the sick grower. Organic acids, organic Zinc and herbs have been successfully used to enhance the immune system. The feed should be of the highest quality and be as easy to digest as possible.

Floor

Stocking density

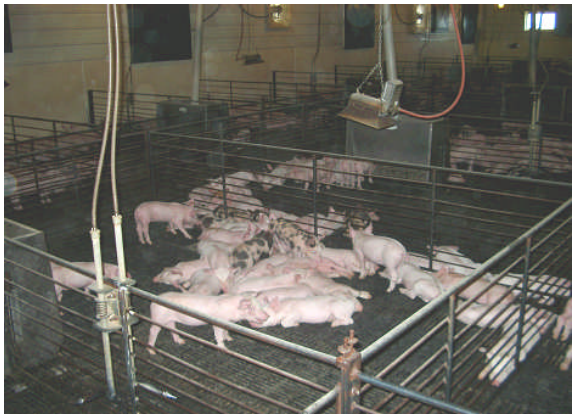
It is essential to provide all finishing pigs with $0.8m^2$ to 100 kg. For pigs over 100 kg it may be worth considering $1m^2$ per pig.

Note straw-based shelter systems need to decrease stocking densities accordingly – for example to $1.5m^2$ to 105 kg

Flooring area

The pig needs to be provided with an area where all the pigs can sleep. Sleep is only really achieved in a draught free zone, which provides a thermoneutral environment – without chilling. Modify the comfort zones within a house to satisfy the pig's requirements. This may

mean that walls have to be moved and pens have to be combined. Smoke rooms to analyse air movement within a building. However, the number one aspect is to observe the pig's lying and dunging patterns.

Observe sleeping and lying patterns- why are the pigs on the left chilled and lying next to the passageway?

Floor consistency

Maintain the floor so that it does not damage the feet and skin of the pigs. Damaged feet provide an entry point for pathogens into the pig. Once through the skin the pathogens rapidly move to the lungs where they can form abscesses and weaken the pig further.

Air and Ventilation

The ventilation system is a major weakness on many pig units that results in respiratory distress. In cases of PMWS it is vital to minimize any ventilation stress. It is vital to avoid ventilation stress that may affect the mucocilary escalator.

Temperature

Pigs need to live within their thermo neutral zone and farmers need to be aware of the temperature requirements of pigs. On many farms pigs are too hot in the summer time due to lack of an adequate cooling system. This places the pig under severe stress and can affect feed intake. It is essential to follow agreed temperature curves, in particular in the first stage nursery.

Draughts and chilling

Draughts/chilling are possibly the number one environmental factor that affects the pig's ability to fight respiratory disease. Draughts are a serious stress factor affecting the animal's ability to sleep properly. Therefore, it is vital that farmers provide pigs with zones in the pen, in particular a draught free sleeping area. A draught can be defined as any air movement in the sleeping area in excess of 0.2m/s. Note holes in curtains/walls can result in unexpected draughts

Gas concentrations

The ventilation system should be maintained to prevent the smell of ammonia (below 10 ppm). Ammonia and carbon dioxide can act as an anesthetic to the mucocilary escalator.

Curtain management

Used properly they can provide good air patterns through cross flow ventilation. However, it is important to ensure the curtains do not result in draughts. Raise the curtain completely regularly to remove any mice nests. Mice can eat through the curtain and results in a hole which can lead to draughts onto the pigs. Curtain controls also need to be reviewed; some systems move the curtain too many times a day.

Fan maintenance

Most farms have very poor fan maintenance programmes. Farmers must be aware that a dirty fan can be 40% less efficient than a clean fan. This results in poor air quality and variable air patterns throughout the building (as fans can have different levels of dust on their blades affecting their performance). Note the large fans in tunnel-ventilated buildings must have their belts checked and tightened regularly.

Dust

There are three aspects to dust; majority of dust fall in the particle size greater than 3.6 μm. Assuming the respiratory tract is not damaged these particles are removed before entering the alveolus. Particles less than 1.6 μm will not settle in the alveolus and will move in and out of the respiratory tract. Only particles between 3 and 1.6 μm will enter the lung alveolae tissues. This is important because viruses require a piggyback to gain entry into the lung tissues.

Humidity

Low humidity less than 50% results in a reduction in particle size and therefore more particles enter the lungs and these can carry disease agents. Dry air also causes injury to the mucocilary escalator. Moisture over 75% results in a damp environment, which overwhelms the respiratory defenses

Medicine Management

General

Medicines are to be appropriately used. While PMWS does not respond to antibiotics, as is it is probably caused by a viral agent. The secondary bacterial infections are usually responsible for causing the actual death of the pig. Note however, that without an effective immune system, the remaining pathogens can still overwhelm the surviving pigs, once the antibiotics are removed.

It is essential to follow veterinary advice and recommendations and keep notes of the relative effectiveness of different routines used in the hospital area.

Dispose of all needles and syringes between batches of pigs. Avoid any blunt needles.

Vaccines

Administration

Vaccines cannot be administered between 15 and 60 kg as many pigs with a failing immune system will not respond to the vaccine and in some cases it may make the pig's condition worse as the pig has to 'fight' the vaccine. Ensure all vaccines are carried out before 15 kg. This can conflict with government pathogen control measures.

Storage

It is essential to store vaccines appropriately. The PCV2 vaccines are affected by freezing.

Stockmanship

Well trained, dedicated, enthusiastic stockpeople are essential to the efficient running of a pig farm. The good stockperson must have sufficient time to look after the animals and not spend all their time just running around maintaining the building. Many stockpeople fail to provide sufficient care due to with a lack of organisation and prioritising ability.

Summary

To many the control of PMWS will be straightforward – vaccinate against PCV2. However, these vaccines are costly – in monetary terms, stockmanship time and involve injecting the pig. Even after vaccination, the management of the pig should be optimized to maximize the benefits of the vaccine. There are many disorders which will affect the profitability of a pig farm which has nothing to do with PCV2. If you are lucky enough to still have a farm without PMWS, every effort should be made to maintain your status.