Managing respiratory disease: precision counts!

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Swine producers and veterinarians are continuously challenged by disease and poor performance in animals under their care. It is performance which should be optimised if the producer wants to survive in times with high feed prices and low revenues.

Despite an evolution to modern swine production systems, it seems that swine respiratory health is still under pressure. Even with the advent of new management technologies, advanced biology, and a better understanding of the complex relationship between respiratory pathogens, their host and its environment, respiratory disease still has to be recognised as a significant problem. Often there is not one single agent that can be identified as the cause of the problem.

Therefore the terminology 'Porcine Respiratory Disease Complex' (PRDC) is frequently used to refer to the interaction of multifactorial etiologies. A short overview of these etiologies and the management tools to approach PRDC are given in this article.

Effect on the lungs

First, let us have a look at the organ affected in case of respiratory disease. The lung is the organ that controls the oxygen and carbon dioxide levels in the body. Besides this very important function, it also plays a role in thermoregulation and control of the pH of the body fluids.

This means that anything affecting the normal function of the lung will automatically lead to more than just coughing alone. In a lot of cases coughing is the only clinical sign, while activation of the immune system, disturbance of physiological pH and body temperature are the factors which reduce the performance of the animals.

Therefore, respiratory health has to be managed very carefully and with knowledge of the most important factors involved.

The respiratory system has a huge surface area of approximately 100-150m^2, which is continuously exposed to the environment.

Haemorrhagic inflammation caused by Actinobacillus pleuropneumoniae leading to acute mortality or chronic pleurisy and pericarditis (Dialab, Belgium).

Pathogens can fairly easily enter the bloodstream through the small barrier between the environment and the blood in the alveoli. That is why the lung reacts very quickly to exogenous agents or antigens. But, in its attempt to destroy, wall-off or dilute the injurious agent, it is clear that the inflammatory response of the lung often causes irreversible damage (see photograph above).

Therefore, it is important to manage the inflammatory response. This may be accomplished, on the one hand by limiting the amount of agents in the air and lung, and on the other hand by limiting the inflammatory response of the lung against antigens, also called immuno-modulation.

Hence, the control of respiratory disease requires an understanding of the complexities and the interactions between the pathogens, the pig and the environment. All these factors are relevant and contribute to the severity of the respiratory disease.

A proper evaluation of the farm ventilation systems is the first step, whereby it is of utmost importance that the ventilation is adjusted to the specific requirements of the animals, taking into account age, category, number of animals per barn etc.

We need an adequate minimum ventilation to get the toxic gases, dust and moisture out of the barn. When temperature in the house is rising, the ventilation can go up. It is very important here not to exceed a certain maximum. This will stress the pigs and lead to respiratory and other problems (like tail and ear biting). Check on a regular basis if ventilation still meets the requirements of the animals.

Managing biosecurity

The next step is managing the spread of the pathogens, the so-called biosecurity. We want to keep out the pathogens, which are not present at the farm (external biosecurity) and limit the impact of the ones already present (internal biosecurity).

To do this, we need a good insight of how a pathogen is behaving, how long it survives in the environment and what it needs to spread and, if for example a pathogen easily spreads through needles, it is logical to focus on this risk factor.

In addition, we also need to get a picture

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of which pathogens are present, at which age category, to what degree they contribute to the respiratory disease complex and what the consequences are on performance. There are several diagnostic tools available, such as serology, PCR and histopathology, which might help us to determine the causative agent and to monitor the health status of the herd.

Nevertheless, there is only one tool that also has a correlation with performance and animal welfare – this is scoring the lungs for lesions at the slaughterhouse. There are several methods described in literature.

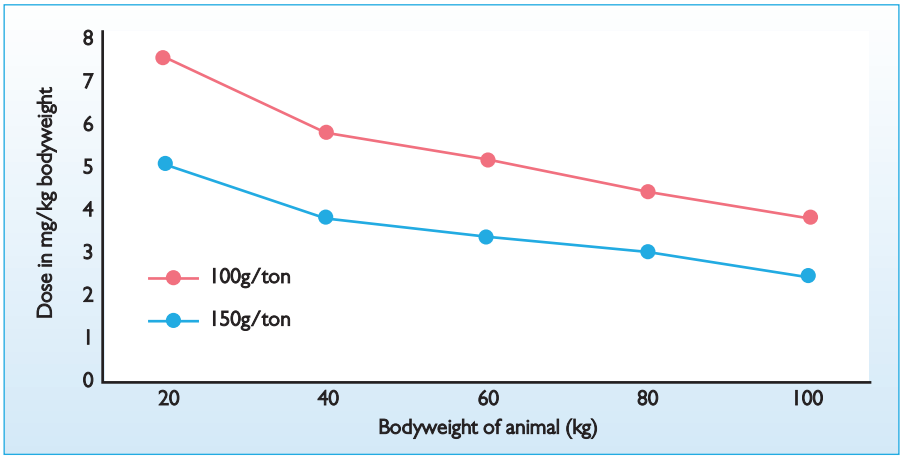

Fig. 1. The evolution of the mg/kg bodyweight with increasing weight at 100 and 150g of active per ton of feed.

Three groups of pathogens

The pathogens can be roughly divided into three groups. The first group represents the viruses. These can cause disease and open the door for secondary diseases, mostly of a bacterial nature. For some of these viruses good vaccines are on the market and should be the first choice of control.

Additionally, the impact of the infection in the animal can be limited through anti-inflammatory drugs. Reports from the field and in-vitro data may also support the antiviral activity of tilmicosin, present in Tilmovet.

The second group are the bacteria. A special one here is Mycoplasma hyopneumoniae, which still seems to play a central role in the respiratory disease complex. The other bacteria can, depending on their virulence, be considered as secondary causing pathogens.

Animals are often carriers and after a provoking factor such as stress, viral infection, Mycoplasma hyopneumoniae infection, the balance between immunity and infection pressure is disrupted resulting in clinical manifestation of the respiratory disease.

The last group are the parasitic diseases. The best known one is Ascaris suum. The larvae migrate through lung and liver causing lesions in the respective organs. Again, this can contribute to the respiratory disease complex.

Use of antibiotics

If vaccination together with optimising ventilation and management, do not succeed to control the disease, antibiotic treatment might be needed. A basic knowledge of pharmacokinetic and pharmacodynamic properties of the antibiotic used, is needed for a correct and precise application in order to get a good response of the treatment.

Antibiotics can be classified based on their pattern of antibacterial activity (see Table 1). The first group of antibiotics is called concentration-dependent antibiotics. If the concentration of these antibiotics is increased, the degree and extent of killing the pathogens is also increased.

Increasing drug concentrations will result in a greater cidal activity in contrast to giving the same total daily dose spread over several doses. These medicines exhibit a prolonged post-antibiotic effect. This means that, in practice, pulse medication will work very efficiently in this group of antibiotics instead of multiple doses over a 24 hour period.

The second group of antibiotics is called time-dependent antibiotics, which kills bacteria to the same extent after reaching a threshold concentration. The goal is to maintain serum concentrations above the lowest concentration that is able to inhibit growth of the bacteria, the so-called minimum inhibitory concentration (MIC), as long as possible during dosing intervals.

This means that, in practice, antibiotics belonging to this group should be given in several doses a day (in feed or water) to maintain concentrations above the MIC as much as possible. Therefore, there is no benefit to give a high dosage to reach tissue concentration several times above the MIC.

Some antibiotics have mixed properties and have time-dependent killing effects as well as moderate persistent effects.

Alongside time of treatment we also want sufficient concentration of the active product in the affected tissues. For example, tilmicosin, the active molecule in Tilmovet, is highly concentrated in the nose epithelium and upper respiratory mucosae in the lung tissue and in the bronchial and tracheal epithelium.

This makes this product a good option for the treatment of respiratory disease.

Moreover, tilmicosin is also highly concentrated in the macrophages, a (immune) cell that is strongly present at the site of infection. Other antibiotics, such as amoxicillin, have a rather low volume of distribution, meaning that they are predominantly concentrated in the plasma.

Table 1. Classification of antibiotics based on antibacterial activity.

Antibacterial activity	Examples
Concentration-dependent	
Aminoglycosides	Apramycin (Apravet)
	Paromomycin
Polymyxins	Colistin
Time-dependent	
Macrolides	Tylosin (Pharmasin)
	Tilmicosin (Tilmovet)
Pleuromutilins	Tiamulin (Vetmulin)
β-Lactams	Amoxycillin
Mixed properties	
Tetracyclines	Doxycycline (Hydrodoxx)

Dosing the antibiotic

Finally, but no less important, is how to dose the antibiotic. A dose can be expressed as grams per ton of feed or as grams per 1000 litres of water. But, if dosed in this way, can often lead to under or overdosing. Older pigs eat and drink less per kilo bodyweight. This means that the same grams per ton will be less grams per kilo bodyweight for an older animal.

Dosing for example 100g active per ton of feed, corresponds for a 20kg pig with 5mg per kilo bodyweight, while for a 100kg pig these 100g active per ton correspond with 2.5mg per kilo live bodyweight. This is illustrated in Fig.1.

Dosing should always be done in milligrams per kilo live bodyweight. This seems a difficult thing to do, but a dose calculator is available to help with this task, such as Huvepharma's dose calculator app (available for android and iphone).

It is clear that solving and managing respiratory disease is a never ending story. The utmost goal is to limit its negative impact on performance and animal welfare as much as possible. To reach this, an intense collaboration between veterinarian, producer, ventilation expert and nutritionist is required.

The challenge is not just doing something, but knowing what you have to do and how to do it! Remember – precision counts! ■