Respiratory diseases in pigs: Mhp, secondary pathogens & inflammation

Porcine Respiratory Disease Complex (PRDC), in which Mycoplasma hyopneumoniae (Mhp) is considered a primary pathogen, accounts for more than half of all the treatments administered to growing pigs.

A survey conducted by Dr Holtkamp in 2014 concluded that Mhp was the single most costly pathogen in finishing barns.

by Dr Jordi Mora,
Global Technical Director,
ECO Animal Health Ltd, UK.
www.ecoanimalhealth.com

The economic impact of this pathogen on the swine industry has not reduced significantly despite the considerable progress in diagnostics, design of ventilation and housing systems and in the development of new antibiotics and vaccines.

It is therefore not surprising that many veterinary practitioners and producers have become so accustomed to the presence of Mhp and enzootic pneumonia (EP) in their pig herds that they seldom reflect on the possibilities and benefits of improving their current Mhp control strategies.

An important characteristic of Mhp is its significant synergy with other pathogens including PRRS virus, swine influenza virus, P. multocida and A. pleuropneumoniae.

The severity of these combined infections is usually greatly alleviated when Mhp is properly controlled.

The role of the immune system in respiratory disease associated with Mhp

One aspect that can be overlooked is the fact that most lung lesions and the resulting clinical signs observed are caused by the host's own inflammatory reaction to Mhp rather than by Mhp itself. There has been considerable media and scientific interest in this aspect of human coronavirus disease.

Immunopathological events play an important role in both Mhp infection patterns and the development of the associated lung lesions.

Mhp organisms stimulate alveolar macrophages and lymphocytes to produce pro-inflammatory mediators that play a role in lung lesion development and cause lymphoid hyperplasia, confirming the involvement of the immune response in the development of lesions (Fig. 1).

In addition, many of the secondary pathogens which exhibit synergism with Mhp also display immunomodulatory properties.

This implies that the majority of commonly seen respiratory conditions in pigs are worsened by the role played by inflammation in the disease process making this an important consideration in the choice of treatment options.

Some macrolides used in veterinary medicine have been studied and shown to have beneficial anti-inflammatory and immunomodulatory actions.

These actions along with their antimicrobial effects improve clinical outcomes in pigs with pneumonia.

Tylvalosin, the active ingredient in Aivlosin, is one of the macrolides shown in studies to reduce inflammation and promote its resolution.

In vitro, it induces apoptosis (beneficial, programmed cell death which prevents toxic intracellular components from flooding into the local host tissues and further increasing damage) of neutrophils and macrophages containing Mhp.

It promotes efferocytosis, the ingestion by macrophages of neutrophils containing Mhp, helping to rid the body of the pathogen.

Finally, it inhibits the production of damaging pro-inflammatory mediators (CXCL-8, IL1α, and LTB4), while inducing the release of beneficial mediators involved in resolving inflammation (Lipoxin A4 and Resolvin D1).

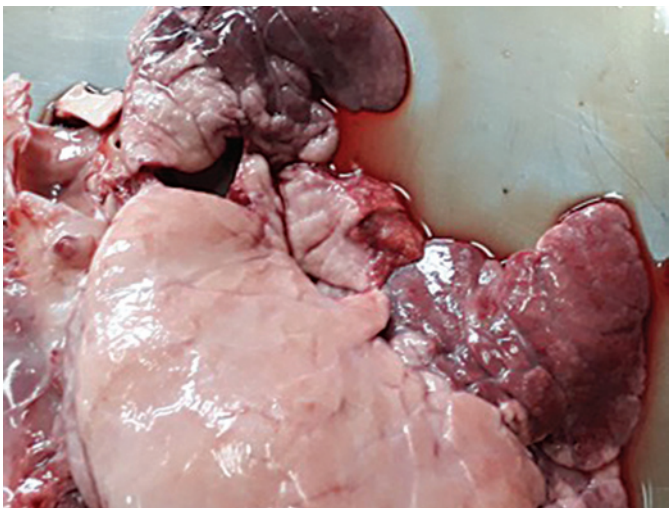
Such anti-inflammatory and immunomodulatory actions could also contribute to the efficacy observed in the treatment of respiratory diseases complicated by pathogens that are not expected to

Continued on page 11

Location	Year	Slaughter pigs with pneumonia reported (%)
Argentina	2016	69.3
Brazil	2016	51.0
France	2016	71.5
Denmark	2017	67.5

Table 1. Percentage of slaughter pigs with lung lesions in different countries (ECO Animal Health studies, 2016-2017).

Fig. 1. Examples of lung lesions associated with Mhp identified at slaughter.



Continued from page 9
respond to macrolides based on their MIC values.

Some proposed explanations for the continued presence of Mhp infections

Both antimicrobial treatment and vaccination have been shown to reduce Mhp infections. Despite vaccination, clinical outbreaks of respiratory disease caused by Mhp still occur frequently.

Similarly, scarce data is available regarding the efficacy of different treatment and vaccination strategies against Mhp in commercial herds infected with this bacterium and other pathogens involved in PRDC.

Answers to these questions are necessary for the development of optimal treatment and control strategies for this disease.

The continued presence of lung lesions associated with Mhp is clearly shown in Table 1, which summarises findings from different studies carried out by ECO Animal Health.

Comparing these results with other historical data strongly suggests that pneumonia rates in pigs, determined using lung lesions detected at slaughter, has barely changed in the last 20-30 years.

How can this be explained given the many advances made in the pig industry over the years?

One could conclude that the measures implemented to control Mhp are no longer as effective as they were once perceived to be. However, in the opinion of the author, the failure to control mycoplasma pneumonia is a reflection of the increased challenges to Mhp control posed by the modern pig industry.

Some of these significant factors include:

- Increasing average farm size.
- Increasing percentage of replacement gilts found in the sow inventory.
- Increasing differences between the health status of source and recipient farms for breeding stock, for example Mhp positive versus negative status.
- Increasing numbers of new pig diseases which may have synergies with Mhp such as PCV2, high pathogenicity PRRS and endemic swine influenza.

With such major changes linked to industry progress, there must surely also be an opportunity to re-evaluate Mhp treatment and control to further improve the health and welfare of pigs.

Important characteristics of Mhp for consideration

Mhp is a unique pathogen with a very particular set of characteristics which must be considered when designing the optimal disease control strategy on each farm.

These include:

- Extremely low rate of horizontal transmission.
- Very extended shedding time by infected sows, in excess of 200 days.
- Vertical transmission from sow to piglets, especially in gilt litters.
- Clinical signs being very closely associated with the infection pressure of each pig.

These characteristics play a major role in the clinical expression of Mhp disease in modern production systems.

The research published by Dr Eduardo Fano and others in 2005 proves a significant relationship between the prevalence of Mhp at weaning and the severity of lung lesions at slaughter.

This work and other research at the University of Minnesota led to the following statement from Dr Pijoan in 2005: "Immunity levels and excretion levels by the sow are the most important factors in the epidemiology of the infections by mycoplasma in segregated weaning programmes."

This is also likely to apply to farrow-to-finish systems managed all in/all out per production batch.

The sow's Mhp status plays a vital role, especially in gilts

As gilts play an increasingly important role in modern production systems, so their Mhp status and excretion along with their individual immunity becomes increasingly important. A key issue is the introduction of Mhp negative replacement animals into Mhp positive production systems.

The delicate balance of ensuring that these newly arrived gilts develop protective immunity against the disease when they are exposed to Mhp on entry to the systems, while preventing them from reinfecting sows already in the system and their own litters, can be a real challenge.

The acclimation of replacement breeding stock to prevent or minimise vertical and horizontal transmission of Mhp must become a key area of focus in modern pig production systems.

Likewise, control strategies for mycoplasma pneumonia should further consider the important role of vertical transmission to reduce as much as possible the percentage of infected piglets at weaning. The possibility of targeted, strategic antibiotic intervention to reduce the prevalence of Mhp in the early stages in the life of the finishing pig can improve overall health and reduce the impact of Mhp-related disease over the life of the pig by reducing infection pressure and preventing clinical expression of the disease.

The possibility of preventing vertical transmission of Mhp with targeted, selective antimicrobial treatment pre-farrowing has been demonstrated in trials. By controlling Mhp prevalence in the early stages of life, the severity of clinical mycoplasma pneumonia later in finishing can be reduced. It is important to consider the choice of antibiotic carefully, as issues such as palatability when treating sows with some macrolides at the inclusion rates required can impact the outcome. Interestingly, the possibility exists that the improved production parameters seen alongside improved enteric health when treating ileitis with some later generation macrolides could be linked to their effects on Mhp.

By essentially treating Mhp at the early stages in the pigs' life when controlling for ileitis, these pigs may have less subclinical Mhp infection and go on to live healthier and more productive lives.

What can we conclude from treatment interventions for Mhp?

Field experiences demonstrate that treatments taking place early in the life of finishing pigs can have a major impact on respiratory health and performance parameters during the finishing stage. Early, short and targeted treatments with antibiotics that are highly effective against Mhp can both prevent vertical transmission and reduce the percentage of infected pigs entering the early stages of production.

This helps to prevent the infection pressure reaching the levels needed for the development of clinical signs of disease. Using antibiotic interventions in this way can make economic sense and reduce the total use of antimicrobials compared to using antibiotics during the clinical stages of the disease. Minimising Mhp related clinical signs and lesions will not only help to improve health and welfare but to reduce their impacts on costs of production.

When antibiotics are needed to treat clinical disease related to Mhp, choosing a macrolide such as Aivlosin that also has anti-inflammatory and immuno-modulatory activities could help to more quickly resolve infection, restoring pigs to better health and productivity faster. ■

References are available from the author on request