Eradication of M. hyopneumoniae by partial depopulation

Over the past decades, the control of Mycoplasma hyopneumoniae has presented a tough challenge for pig producers and veterinarians throughout the world. This pathogen is ubiquitous within swine herds and is the causative agent of enzootic pneumonia, characterised by non-productive coughing.

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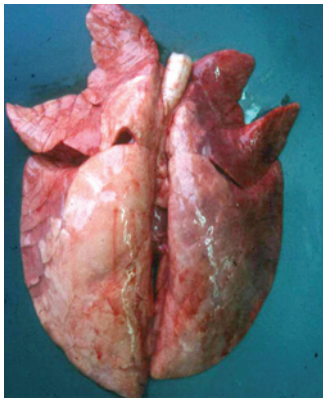
The attachment to the cilia of the respiratory tract by different adhesins and lipoproteins results in a diminished function of the mucociliary apparatus. The subsequent damage of the cilia and epithelium, together with a down-modulation of the immune response at later stages enhances secondary invasion by other bacterial and viral infections.

Furthermore, the infection shows persistence for several months, indicating a certain degree of immune evasion of the microbe. Therefore, M. hyopneumoniae is generally considered to be the key trigger in the Porcine Respiratory Disease Complex.

Both acute and chronic respiratory symptoms are responsible for major economic losses due to decreased productivity such as impaired daily weight gain and feed conversion rate, increased number of poor performing pigs, higher mortality rate and repeated use of antimicrobials.

A reduction of 6-16% in the growth rate of finishing pigs is reported. Pigs showing the highest pneumonia score need one additional week to slaughter. Unfortunately, the overall prevalence and the economic impact of these small bacteria is much higher than one would expect at first sight.

Cranio-ventral pulmonary consolidation after M. hyopneumoniae infection.



Options for control

Several options are possible to control M. hyopneumoniae infections in the field:

- **Vaccination:** Vaccination of the piglets against M. hyopneumoniae improves performance parameters in fattening pigs. Although a considerable number of piglets are vaccinated nowadays, typical mycoplasma lung lesions are still frequently detected at slaughter.

We should bear in mind that the vaccination of piglets does not stop further colonisation and horizontal spreading among pigs. Vaccination reduces clinical symptoms only to a certain extent. Vaccine efficacy is significantly lower if the vaccine strain does not cross-protect against the circulating field strain(s). Simultaneous circulation of viruses like PRRS or PCV2 also adversely affects the efficacy.

- **Antimicrobial treatment:** Antimicrobials active against M. hyopneumoniae never eliminate all mycoplasma organisms in a herd with active shedding of the pathogens, logically resulting in endemic infections.

- **Eradication:** Eradication is by far the most effective and cost-efficient way, depending on the severity of the disease. In a naive herd, technical performances improve rapidly and significantly.

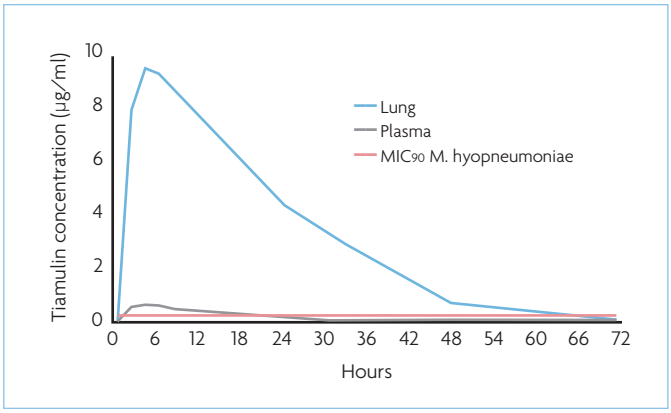


Fig. 1. Plasma and lung concentrations of tiamulin following a single injection at 15mg/kg bodyweight in pigs (McKellar et al, 2004).

Consequently, the repeated use of antimicrobials and a preventive vaccination programme against M. hyopneumoniae can be stopped. Eradicating mycoplasma facilitates the control of other concurrent infections such as PRRS and PCV2.

Eradication

Each eradication programme starts with a conclusive diagnosis of a M. hyopneumoniae infection, based on clinical symptoms and confirmation by laboratory testing.

The catarrhal pneumonia leads to consolidation of the lung and is mainly observed in the cranio-ventral lobes when a slaughterhouse check is performed (see picture).

Bacterial isolation is difficult and time-consuming. Hence, other diagnostic techniques such as PCR tests (lung tissue, swabs or bronchio-alveolar lavages), serology, histo-pathology, immunohistochemistry and immunofluorescence assays are frequently applied.

M. hyopneumoniae can be eliminated from sow herds in two ways:

- **Total depopulation** and repopulation with specific pathogen free pigs after thorough cleaning and disinfection of the whole farm. More than one disease can be eradicated at once.

This is the most straightforward method of disease eradication but unfortunately, it also means a high economical gap.

- **Partial depopulation.** This procedure includes temporary changes in the pig flow and strategic medication. The cash flow disruption is less with this alternative due to reduced production losses and the maintenance of the genetic potential and parity profile.

Different methods can be used to eradicate mycoplasma. Logically, all must fit with the unique aspects of each specific farm. The estimated success rate in the field is 80-90% and always results in a higher health status, improved technical performances and a motivational lift for the staff. The payback period depends on several case specific factors but is usually within one year.

Protocol of partial depopulation and strategic medication

Partial depopulation in combination with a medication programme should not be initiated in pig herds with an active infection level and requires the removal of all groups of animals where shedding and transmission of mycoplasma can not be stabilised.

Animals in excess of 10 months of age have normally built up high

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levels of immunity to mycoplasma, lesions have healed and shedding is low.

Pigs less than 10 months of age are often found to be highly infectious and shed mycoplasma profusely. Therefore, all animals from three weeks until 10 months of age should be removed from the farm and weaned off site. All empty units are cleaned and disinfected thoroughly.

A high level of internal and external biosecurity is a must to avoid propagation inside the farm as well as the re-introduction of new pathogens.

Pig dense areas are at higher risk due to airborne transmission. Therefore, the distance to infected neighbouring herds should preferably be more than 2km.

Hygiene protocols like clean trucks on the farm and registration of visitors are crucial. In case of a continuous unstable herd, a prior vaccination of the sows and gilts is advised to achieve immunological stability. The breeding herd should be closed to new animal introduction for three months before medication starts. Hence, the farm is overstocked with replacement breeding stock prior to closing to compensate for normal attrition during herd closure.

Sick animals older than 10 months of age showing a lack of appetite are culled from the farm or euthanised before the start of the programme. Due to warmer temperatures and higher ventilation rates, summertime is the ideal season to start eradication.

All remaining sows and boars are treated either in feed or in drinking water with a selected antimicrobial. This antimicrobial has not only to show a superb efficacy against M. hyopneumoniae in the laboratory but also to penetrate the targeted lung tissue to a large extent.

Therefore, most successful eradication programmes have been conducted with tiamulin, which is a non-critical antimicrobial belonging to the class of the pleuromutilines.

The minimal inhibitory concentration of tiamulin to inhibit growth of 90% (MIC_{90}) of the M. hyopneumoniae strains tested is not more than 0.06µg/ml (Table 1).

This molecule does not only show an excellent absorption after oral administration and a low plasma protein binding capacity but also high tissue concentrations in the lung. The exposure to tiamulin is 18 times higher in lung tissue compared to plasma (Fig. 1).

As the survival time of the pathogen outside the pig's body is reported to be short, a treatment duration of 14 consecutive days is advised. The daily dosage is 10mg tiamulin hydrogen fumarate per kg bodyweight. Special attention has to be paid to correct dosing, mainly for the sows in the lactation units. Sows refusing to eat are removed or injected with tiamulin for five consecutive days. If they still do not eat after the injections, they should be removed from the herd.

Vetmulin, Huvepharma's brand of tiamulin, is available in many different formulations fitting to all specific requirements in the field and guarantees efficacy and safety:

- A microgranulated premix and oral granules.
- A powder and solution with excellent solubility in drinking water.
- An injectable formulation.

The administration of the antimicrobial product is also efficacious for controlling several concurrent infections like ileitis, Brachyspira spp, Mycoplasma arthritis and bacterial pneumonia. This clearly contributes to the significant performance boost after the eradication programme.

Suckling piglets

Transmission of the infection from the suckling piglets to the sows during the two week treatment period can be avoided in two ways:

- Farrowing stop of at least 14 days during the two week treatment period of the sows.
- Continuation of farrowing even during the medication period. In this case, all the suckling pigs in the farrowing units are injected with a long acting product (tulathromycin 2.5mg/kg bodyweight) every four days, starting from one week before the start until the end of the medication programme of the sows.

The piglets are preferably weaned before three weeks of age to reduce the risk of re-infection of the lactating sows. Poor-doing piglets are euthanised.

Only pigs originating from sows that have already been treated for the full 14 days prior to giving birth are 'clean'. They should be housed in nurseries that have been thoroughly cleaned and disinfected at least one week before transfer.

	MIC_{50} (µg/ml)	MIC_{90} (µg/ml)
Enrofloxacin	0.03	0.5
Marbofloxacin	0.03	0.5
Spiramycin	0.06	0.25
Tulathromycin	≤0.001	0.002
Tylosin	0.03	0.12
Tiamulin	0.016	0.06
Valnemulin	≤0.001	≤0.001
Florfenicol	0.25	0.5
Oxytetracycline	0.06	0.25

Table 1. MIC distribution for nine antimicrobial agents against 50 Mycoplasma hyopneumoniae isolates in pigs; BE n= 16, SP n= 14, UK n=20 (Klein et al, 2017).

Post treatment period

Logically, further close monitoring of the pathogen is recommended by clinical inspection of the pigs in the herd, repetitive serological tests, PCR tests and slaughterhouse checks for typical mycoplasma lesions. All pigs introduced after the eradication programme should have at least a mycoplasma free status and certificate.

Furthermore, a properly cleaned and disinfected quarantine on arrival and a correct and continuous implementation of all biosecurity rules is obligatory to avoid re-infection.

The improved biosecurity level directly contributes to the high and fast return on investment.

Conclusion

Mycoplasma hyopneumoniae can be successfully eradicated by a well-considered combination of partial depopulation of all younger animals and a strategic medication plan in sows and suckling piglets. Immune stability in the closed group and biosecurity is crucial.

This protocol requires full commitment from all the farm staff and a strict application of a written protocol. Huvepharma is your reliable partner for tailor-made eradication programmes. ■

References are available from the author on request