Porcine Enzootic Pneumonia at a glance
by F. Madec* & Ph. Leneveu**

1. A high risk in confined industrial farms

The evolution of Pork Production systems towards intensification has brought considerable changes to the environment of the pigs. This has allowed some specific eradication programmes of major pests (FMD, CSF, Aujeszky’s Disease, brucellosis…). Nevertheless farms still experience several diseases, some of which with multifactorial origin. This article relates to respiratory disorders in the dominating pig farming system, the confined intensive system.

The production sites are more and more specialized, have increased in size, looking for scale savings. More and more animals are raised in huge groups in closed buildings with limited space allocation. This is named intensive confined systems. All zootechnical specifications have been determined with/for healthy animals. Many observations show a clear trend for the development of respiratory diseases in this kind of systems, when management is inappropriate. Strict compliance with the zootechnical rules and adaptation to the health status of the animals is therefore a key issue.

Respiratory disease concerns mostly the growing finishing phase of the pigs, affecting particularly the lung and its envelope (pleura). Numerous pathogens are associated with lung lesions (viruses, bacteria, parasites) and thus the expression Pig Respiratory Disease Complex is used to reflect the complexity of respiratory disorders regarding both the isolated pathogens and the induced lesions. Nevertheless, pneumonia is the most frequent infection with a pivotal microorganism, *Mycoplasma hyopneumoniae*, generally followed by cohorts of other pathogens.

2. Focus on *Mycoplasma hyopneumoniae*, the trouble initiator micro-organism...

*Mycoplasma* have long been ignored, because their isolation was difficult at the lab level. During the 50’s the “virus of pig pneumonia” was evoked. *M. hyopneumoniae* was isolated in the mid 60’s. This is a small bacteria with a common size of roughly 1 μm. Differences are noticeable like the genome size is smaller (less than 1 million base pairs, when *E. coli* has 5 millions bp), but especially by the nature of its envelope. *In vivo* - the pneumonia induced by *Mycoplasma hyopneumoniae* « per se » can be obtained in experimental conditions after inoculating SPF pigs. Dry cough, sometimes whooping, occurs. At post-mortem when the disease is well established, macroscopic lesions target mostly the cardiac and apical lung lobes, as well as the azygos lobe. Damaged areas appear dark red or brown, but also harder (consolidation is the word used for pneumonia lesions). The massive proliferation of Mycoplasma, its adhesion to the ciliae and their progressive abrasion induces bronchial irritation and causes respiratory congestion (ciliostasis, mucus and cellular debris,…). This is expressed by dry coughing, more or less deep, sometimes whooping, related to the extension of the colonization and breathing difficulties. Cough is a spasmodic reflex contraction of the chest, occurring when the airways are irritated or congested. The concurrent presence of other bacteria in the respiratory tract (e.g. *Pasteurella multocida*,…) can quickly aggravate the picture, once the first line of defence has been damaged. A viral infection (Influenza, PRRS,…) can interfere the same way and aggravate the clinical situation.

*M. hyopneumoniae* as sole pathogen

- the pneumonia induced by *Mycoplasma hyopneumoniae* « per se » can be obtained in experimental conditions after inoculating SPF pigs. Dry cough, sometimes whooping, occurs. At post-mortem when the disease is well established, macroscopic lesions target mostly the cardiac and apical lung lobes, as well as the azygos lobe. Damaged areas appear dark red or brown, but also harder (consolidation is the word used for pneumonia lesions). The density of affected territories is so increased that they sink during a flotation test. They are clearly different from healthy areas, pink and soft when palpated.

Microscopic exam (histology) reveals the accumulation of neutrophilic cells in the airways, and mononuclear contrast with the efficacy *in vivo* of the colonization of the mucosa of the porcine respiratory apparatus in the farms and the related lesions.

3. How to diagnose a *M. hyopneumoniae* pneumonia?

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cells (lymphocytes, monocytes) infiltrations around the bronchi, the bronchioles and the blood vessels. Later during the infectious process nodule-like lymphoid tissue can be seen. In a favourable environment the coughing decreases and lesions disappear within a few weeks. The pulmonary tissue resumes the normal aspect and function, as the initial lesion is replaced by a temporary scar. Thus, these scar lesions have to be noticed as a sign of an older and more important lesion.

Co-infections with Mycoplasma hyopneumoniae

- In most of the farms Mycoplasma hyopneumoniae is associated with other microorganisms. Dealing with complicated pneumonia, clinical signs are more pronounced: the cough becomes more frequent and persists, can turn thick, raucous, deep, whooping... Fattening pigs are in general most concerned and within the pens a great range in clinical expression and individual behaviours can be seen. During the evolution of the disease fever and loss of appetite can be seen in a few pigs. The generated pain can even produce dyspnea, best known as abdominal breathing. Not only the lung can be affected but also the pleura (pleuritis) and even the pericardium (pericarditis). Extended pleural lesions like acute pneumonia generate a deep painful breathing especially during exercise. Super infected pneumonia lesions cover a variety of lung degradations. Macroscopic lesions look consolidated with variable colours (from grenade to light brown), more or less extended even to the diaphragmatic lobes. During post-mortem exam, section and pressure can release some pus (evidence of super infection). At this step, Microscopic lesions are even seen in the interstitial tissue. Sometimes abscesses can be detected.

- when coughing is associated to macroscopic and microscopic pneumonia lesions Mycoplasma hyopneumoniae can be suspected alone or with co-infection. Diagnostic is nevertheless assessed only with the germ detection.

Diagnostic

- cultivation and microscopic examination are the classical method in Microbiology. Alas, in case of Mycoplasma hyopneumoniae, routine is too difficult. Recent development of PCR [Polymerase Chain Reaction] tests allows the detection of the germ’s genome from various samples like lung tissue, nasal or tracheal or bronchial mucus. Nowadays this is the test of choice, a quantitative evaluation of the infectious load being even possible (qPCR, quantitative PCR). This is a valuable information for the farm health management as long as a low challenge can be tolerated where a high challenge brings unavoidably a severe clinical signs and damage to the animal’s welfare as well as its performances. Eradication of Mycoplasma hyopneumoniae is very difficult apart from depopulation-repopulation with healthy pigs, thus a low pressure should be sought and maintained stable. Animals should be offered adequate environmental conditions matching their needs in space, handling (avoid commingling) and hygiene. This encompasses the sow herd, which is the contaminant reservoir. The suckling period is indeed an exposition phase for the young piglet. In the field, sampling mucus from the trachea with a catheter is the method of choice, easy to perform without anaesthesia on living animals, it can be coupled with a PCR detection technique for Mycoplasma hyopneumoniae. A qPCR can add information on the infection pressure. Anti-Mycoplasma hyopneumoniae antibodies in the blood can also be found with an ELISA test in order to retrace the infection. Quality of antibodies detection is inherent to the test’s features. Sensitivity of commercial tests remains low, but also depends on the timing of sampling versus the dynamics of contamination and its pressure on the animals. False negative reactions can occur. Therefore serology should be restricted to the estimation of a group positivity not an individual. At last a slaughter check can give a nice overview of the situation and allows quantifying the extent of lesions.

4. Elements for a conclusion

Swine Enzootic Pneumonia is a frequent health problem in pigs kept in confined intensive systems. Its development to the level of prejudice supposes the presence of specific pathogenic microorganisms and particularly Mycoplasma hyopneumoniae, as well as deficiencies in the environment offered to the pigs. This latter conditions greatly affect the infection pressure, which in turn influences the severity and the permanence of the disorders.

Recent research confirms the major economic impact of pneumonia on performances, margin being affected from 3 to 5 € per produced pig.

This work also shows the essential role of initiator played by Mycoplasma hyopneumoniae in pneumonia. Detection and quantification techniques do exist. Investigations have also shown the great variability amongst the Mycoplasma hyopneumoniae isolates, with huge differences in the genomic features but also virulence. Different strains can be found in the same farm, even in the same animal. Thus we could have expected interferences and even cross protection, but this has to be still demonstrated. Finally, Mycoplasma hyopneumoniae is a disconcerting pathogen, which we still have to domesticate, silence if not eradicate from our herds.
Normal ciliated epithelium of the respiratory apparatus (bronchi, enlargement 2400-fold). Mucus producing cells (in non ciliated zones) and large quantities of vibratile ciliae (borne by the ciliated cells).

Colonization of the ciliated area by M. hyopneumoniae leads to a progressive destruction of the ciliated cells. Muco ciliar defence is altered and super-infections are permitted (e.g. by P. multocida) generating a complicated pneumonia.

Histology: lesion due to M. hyopneumoniae

Tracheal mucus sampling for isolation of Mycoplasma hyopneumoniae
Distribution of 182 pig lungs sampled at slaughter from two different farms. Scoring of the lesions lobe by lobe, from 0 (absence of pneumonia) to 4 (full or nearly full extension of pneumonia to the lobe). Lung score is obtained by adding the scores of the 7 lobes. At slaughter the lungs must be scored at random, with a minimum of 30 lungs per batch. A lung with a score of 10 or above signals an extended pneumonia. An average batch score of 5 or above reveals a serious concern about the farm health.

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2 This natural feature is named mucociliary clearance mechanism, or mucociliar escalator. The mucus produced by specialized epithelial cells is moved by the ciliae and carries the impurities upstream until the pharynx where they are swallowed.

3 In this case the correct word is Bronchopneumonia

M. hyopneumoniae (cells observed in electronic transmission microscopy).