Lung Lesions in Pigs at Slaughter: A 2-Year Epidemiological Study in France

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ABSTRACT

Lung lesions scoring at slaughter is difficult to plan and organize in pig production for veterinarians in France. A study was carried out as a service offered to veterinarians. All the herds for which they were interested in having lung scoring were proposed to be included into the study. For this, 7 technicians were trained to perform lung examinations and dispatched among the main French slaughterhouses from October 2003 to March 2004. In total, 110,865 pigs from 1196 herds located in the main area for pig production in France were scored. The majority of the herds were vaccinated against *Mycoplasma hyopneumoniae* for more than one year (899 herds). For all the herds, the pneumonia-free mean rate was 27.6%, the pneumonia mean score was 3.7/24, the pleuritis rate was 14.4%, and the abscess rate was 2.3%. The scoring system was strictly applied and allowed to detect small lesions with probably no clinical impact. However, large lesions have been also considered. Hence, almost 10% of the herds present more than 30% of lungs scored 10/24 or more. The vaccinated herds (VH) showed significantly less lesions than non-vaccinated herds (NVH). The pneumonia mean score was 3.50 in the VH versus 4.13 in the NVH, and the mean rate of lungs scored 10/24 or more was 10.2% in the VH versus 14.6% in the NVH. Even if our study can not be considered as a real prevalence study (herds were not randomly selected), the high number of pigs examined give an interested view of swine herds in France. Despite the large use of *Mycoplasma* vaccine, respiratory diseases have not completely disappeared. This demonstrates that veterinarians and farmers must still pay attention to this topic and its risk factors.

INTRODUCTION

Respiratory diseases are common worldwide in swine areas and are of great eco-

nomic importance (growth, feed efficiency, treatment costs, etc.). According to Grest and colleagues,[1] the prevalence of lung lesions varies enormously in slaughterhouse surveys from different countries. The prevalence of pneumonia lesions ranges from 6% to 81%, pleuritis from 2% to 28%, and pleuropneumonia from 1% to 11%.

Recent information on the prevalence of respiratory diseases in fattening pigs in France was lacking. Veterinarians have made some lung controls in slaughterhouses to monitor respiratory diseases. A limiting factor for them is the difficulty to plan and organize the controls. However, they are interested in having a better knowledge of the general situation in their country in order to improve understanding of their own observations.

Therefore, the aim of this study was to evaluate the importance of respiratory disease in an entire region. To achieve the objective of getting a large picture of the situation, we chose to include all the herds of which veterinarians were interested in having lung scoring. Thus, this choice implies that herds were not randomly selected.

The first part of the study was carried out from October 2003 to December 2003 and allowed the control of 959 herds located in Brittany (27,208 km^2, 57% of French commercial pigs). The second part of the study was conducted in the region of the Loire Valley (32,404 km^2, 11% of French commercial pigs), neighbouring Brittany, from February 2004 to March 2004 using the same method. In this second part, we controlled 237 herds. This article displays all the results of the study.

MATERIAL AND METHODS

Herds

The study was conducted as a service offered by Boehringer Ingelheim France to veterinarians. Boehringer Ingelheim France asked ISPAIA (Institute for Animal Productions and Agro Industry) to carry out lung examinations in slaughterhouses. Thus, the veterinarians only gave to ISPAIA the identification numbers of the herds they were interested in lung scoring. Veterinarians had to complete a secured Internet form with herd features and send it to ISPAIA. Depending on companies, the veterinarians chose to send the list of all the herds they had in charge or made a selection. Therefore, herds were not randomly selected. Moreover, only commercial herds were included. Forty-four veterinarians took part in the study, selecting 2 to 82 herds.

Veterinarians had to give the following information about each herd: kind of activity (farrow-to-finish or finisher), size, and vaccination against *Mycoplasma hyopneumoniae* (piglets), rhinitis (sows), or porcine reproductive and respiratory syndrome virus (PRRSV; weaned pigs). For vaccination, veterinarians had to give detailed information: "yes for more than 1 year," "yes for less than 1 year," or "no." The acknowledgement of this form was the condition to send the lung examination results to the veterinarian; thus, observance was good. If one herd was followed by several veterinarians and if there were differences in their internet forms, the herd was excluded from the analysis. When there were several lung examinations on different days for the same herd, all the lungs were added to consider one examination per herd.

Scoring

The scoring system used has been previously described[2,3] and has been adapted for this study (Table 1). For practical reasons (speed of the slaughtering process) the azygous lobe was not scored, so that lungs were scored for pneumonia out of 24 (6 lobes × 4). Abscesses were scored as 0 for absence and 1 for presence.

The technicians strictly observed this diagram. They were equipped with Dictaphones, so that they could score visually and by palpating. Moreover, they checked the adequacy between the lung they were scoring and the herd identification on the carcass. To limit mistakes, first and last

Table 1. Scoring System.

Score	0	1	2	3	4
Pneumonia lesion (evaluation per lobe)	None	Surface with lesions less than a coin of 2 *	Surface with lesions between a coin of 2 *	Surface with lesions between half to three-quarters and half of the lobe	Surface with lesions up to three-quarters of the lobe
Pleuritis lesion (evaluation per lung)	None	Pleuritis between lobes	Surface with pleuritis less than a coin of 2 *	Surface with pleuritis up to a coin of 2 *	Partial or total adhesion of the lung to the carcass

*A coin of 2 corresponds to an area of 5 cm^2.

Table 2. Lesions Observed at Herd and Lung Levels.

	Number	Pneumonia-Free Mean Rate	Pneumonia Mean Score	Mean Rate of Lungs Scored ≤5/24	Pleuritis Rate Rate	Abcess Mean Rate
Lungs	110,865	28.1%	3.7	29.4%	14.5%	2.3%
Herds	1196	27.6%	3.7	29.2%	14.4%	2.3%

lungs for each herd were eliminated. In order to prevent a selection of the lungs during the examination (healthy lungs are easier to evaluate), each technician had to keep the same interval between scored lungs for each examined herd (for example, 1 lung over 2, 2 lungs over 3, according to the speed of the slaughterhouse process [500–800 hogs/hour]). For inclusion in the study, examinations had to be performed on a minimum of 30 lungs. This minimum allows a 10% prevalence detection at a 5% confidence interval.

Technicians

For the first period, 7 technicians were dedicated to the lung examinations, one per slaughterhouse. In slaughterhouse D, 2 technicians were necessary because of the important slaughtering duration. For the second period, these 2 technicians were dispatched amongst the 3 slaughterhouses (G–I; Figure 1). Technicians were trained to perform lung examinations during 3 days. Then they were allocated to one slaughterhouse, evaluated in this slaughterhouse and then validated (between 1 and 2 weeks after the training depending on the person). Afterwards, in order to maintain the inter-technician consistency, assessment exercises of the same lungs were carried out regularly. Moreover, each month, each person was assessed in his slaughterhouse by the veterinarian coordinator. On average, each technician was evaluated every 10 days.

Data

Data were analyzed at herd level and not at lung level because herd level is more pertinent. Moreover, differences were small (Table 2).

As data are not randomized, results are mainly descriptive. However, statistical analysis has been performed to analyze the relation between lung examination values

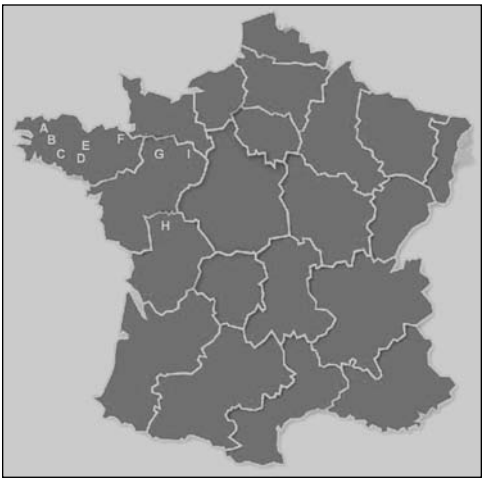

Figure 1. Location of the slaughterhouses (letters A to I).

Table 3. Observations Per Period.

	Number of Herds	Number of Pigs	Pneumonia Free Mean Rate	Pneumonia Mean Score	Mean Rate of Lungs Scored ≥5/24	Pleuritis Mean Rate	Abcess Mean Rate
First period							
Slaughterhouses A–F	959	92,791	27.5%	3.8	30.2%	15.6%	2.4%
Second period							
Slaughterhouses G–I	237	18,074	28.4%	3.2	24.8%	9.8%	1.5%
Whole period	1196	110,865	27.6%	3.7	29.2%	14.4%	2.3%

Table 4. Distribution of herds

		Proportion of Herds Vaccinating for More Than 1 Year		
	Number of Herds	*M. hyopneumoniae*	Rhinitis	PRRSV
Finisher	229	72.5%	43.4%	3.5%
FF (≤100 sows)	191	59.2%	44.0%	1.6%
FF (101-200 sows)	516	80.4%	73.3%	3.1%
FF (201-500 sows)	224	79.5%	74.5%	4.0%
FF (>500 sows)	36	75.0%	88.9%	5.5%
Total	1196	75.2%	63.6%	3.2%

FF = farrow-to-finish.

per herd and *M. hyopneumoniae* vaccination (ANOVA after data normalization; tests performed using SYSTAT 9.0 software [SPSS Inc., Chicago, Ill]).

Slaughterhouses

Six slaughterhouses (A–F on the map; Figure 1) were included during the first period (October to December 2003) and 3 (G–I) during the second period (February to March 2004). These slaughterhouses were among the biggest in France.

As the results (Table 3) are quite similar between the 2 periods and the 2 groups of slaughterhouses (group A–F and group G–I), data were analyzed all together. This statement was reinforced by the fact that, in one hand, 40 herds from the Loire Valley delivered their pigs in the slaughterhouses A–F during the first period and, on the other hand, 70 herds from Brittany delivered their pigs in the slaughterhouses G–I during the second period; thus, the 2 regions were quite similar.

RESULTS AND DISCUSSION

Herds

This sample is composed of 1196 herds. The mean number of lungs examined per herd is 93 lungs (minimum, 30). Among the herds, 81% are farrow-to-finish farms (Table 4), 75.2% vaccinated against *M. hyopneumoniae* and 63.6 % against rhinitis. Vaccination of pigs against PRRSV was quite scarce in France at study time. Interestingly, the largest herds in the study are the most vaccinated against rhinitis. This is not true for *M. hyopneumoniae*.

As previously mentioned, herds were not randomly selected because veterinarians targeted the herds for which they were particularly interested in having lung scoring. Typology of herds (Table 4) confirmed that this sample is not representative of the French swine herd population: in this study 81% of the herds are farrow-to-finish farms vs 72 % according to the national data in 2003.[4] In the same way, the largest farrow-

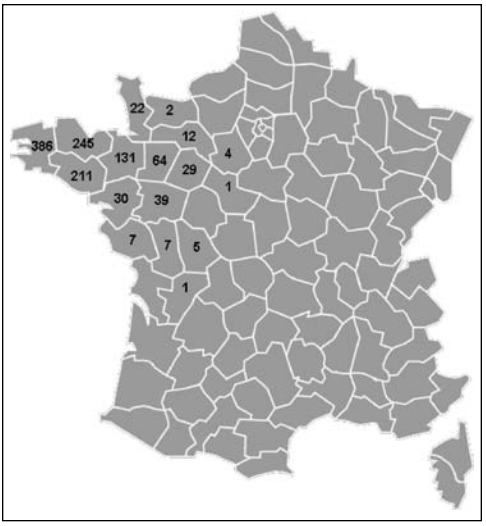

Figure 2. Number of herds included per county.

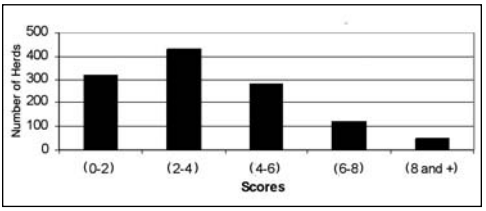

Figure 3. Distribution of pneumonia mean lung score.

to-finish farms are over-represented in our sample. Moreover, the herd location is not exactly representative of the production per county (Figure 2). Thus, this work can not be considered as a prevalence study.

Pneumonia

The mean percentage of lungs without pneumonia lesions is 27.6% and the mean lung score (3.7) is quite high (Table 3). Pneumonia lesions observed were widely distributed (Figure 3).

This statement may be due to the severity of the applied scoring. Even very small lesions, with probably no clinical impact, were recorded. Such small lesions were rather frequent. For example, 62% of the lungs have been evaluated behind or equal to 3 out of 24 (Figure 4).

In parallel, the analysis of the percentage of lungs with scores ≥10/24 shows a rather high percentage of herds with severe

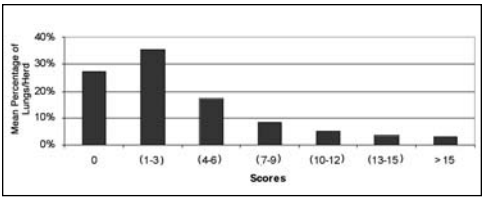

Figure 4. Distribution of lung score per class (mean of herds). On average, in the herds, 35% of lungs belong to the class of score 1-3.

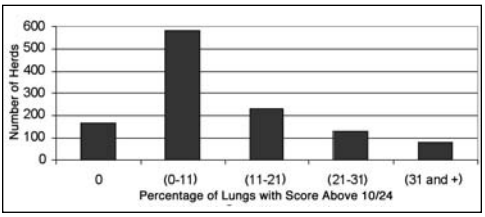

Figure 5. Distribution of herds according to the percentage of lungs with scores ≥10/24. Almost 10% of the herds present more than 30% of lungs scored ≥10/24.

lesions (Figure 5). This indicator is probably a better reflection of the clinical impact.

These results are quite similar with those observed by Madec and Kobisch[2] in France and Bahnson et al[5] in the USA, but different from the 1992 observations of Grest et al[1] in Switzerland. In any case, the severity of the scoring is a determinant aspect when comparing studies (Table 5). Unfortunately, it can not be evaluated.

In France, lesions seem to be similar between periods (1982 and 2003), whereas the context has changed. Some respiratory risk factors have increased, but pig management has improved and for a few years, clinical observations improved as well. For example, veterinary health expenditure, which had increased by 7% between 1991 and 1995, remained stable between 1995 and 2001 and became mainly preventive, in particular in the management of respiratory pathology.[1,6] In preliminary results,[7] we had hypothesized that a part of the lesions observed could be perhaps due to the heat wave of 2003. Considering the similarity of results between the two parts of the study (Table 2), we cannot consider this hypothesis anymore.

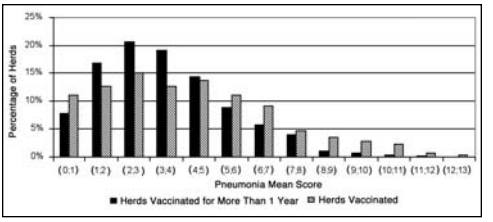

Figure 6. Results of other studies. Distribution of herds according to their pneumonia mean score and their status for vaccination.

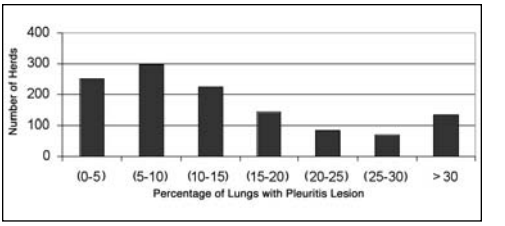

Figure 7. Distribution of herds according to the percentage of lungs with pleuritis lesion.

Table 5. Results of Other Studies Percentages of Lungs with Pleuritis Lesion

Authors	Number of Herds	Number of Lungs	Percentage of Lungs Without Pneumonia	Percentage of Lungs With Pleuritis
Madec and Kobisch, 1982 (F)	225	7,543	34%	17.1%
Bahnson et al, 1992 (USA)	not indicated	not indicated	29.3%	14.2%
Grest et al, 1992 (CH)	561	8,921	56.3%	22.7%

Relation Between *M. hyopneumoniae* Vaccination and Pneumonia

Statistical analysis was performed to assess the relation between vaccination against *M. hyopneumoniae* and pneumonia. The results are presented in Table 6. For the pneumonia-free mean rate, there is no significant difference between the herds vaccinated for more than 1 year and non vaccinated herds. However, more classically, pneumonia mean score, pneumonia mean score of pneumonic lungs, mean rate of lungs scored ≥5/24, and mean rate of lungs scored ≥10/24 are lower in herds vaccinated for more than 1 year compared to non vaccinated herds. In our study, vaccinated farms have significantly fewer animals with severe lesions as shown in Table 6.

These results are slightly different from the preliminary ones.[7] In the current study, pneumonia rates are similar between non-vaccinated herds and herds vaccinated for more than 1 year. One hypothesis could explain this observation. One can imagine that two different sub-groups compose the population of non-vaccinated herds: "healthy" herds with low pneumonia rates and "ill" herds with rather higher pneumonia rates. A graphical comparison of vaccinated and non-vaccinated herds was realized in order to assess this hypothesis (Figure 6).

The 2 populations are not exactly similar. In the vaccinated population, the score distribution is roughly normal. In the non-vaccinated population, we observe a different distribution, with a higher proportion of herds with low lesions scores and, on the other hand, a higher proportion of herds with high lesions scores. These patterns are in agreement with the hypothesis of a non-vaccinated group composed of 2 distinct sub-populations.

This hypothesis could explain the "bad" results of the herds in which mycoplasma vaccination was recently implemented: it can be supposed that these herds were initially in the "sick" population, and are now in an improving phase.

Pleuritis

Pleuritis lesions were observed on 14.5% of lungs (Table 2) but the distribution was quite wide (Figure 7). Similar percentages were reported by previous surveys. Bahnson and colleagues[5] showed a pleuritis prevalence of 14% in Minnesota and Grest et al[1] showed 20% in Switzerland.

There is no significant difference in pleuritis mean rate between herds vaccinated for more than 1 year or non-vaccinated herds against *M. hyopneumoniae* (14.5% vs 13.1%, respectively; $P = 0.109$).

Table 6. Relation Between Vaccination Against *M. hyopneumoniae* and Pneumonia Lung Lesions.

	Herds Vaccinated for More Than 1 Year	Herds Vaccinated for Less Than 1 Year	Non Vaccinated Herds	*P*-Value
N	899	44	253	
Pneumonia-free mean rate	28.2*	18.6†	27.2*†	0.004
Pneumonia mean score	3.50*	4.87‡	4.13†	<0.001
Pneumonia mean score of pneumonic lungs	4.6*	5.8†	5.2†	<0.001
Mean rate of lungs scored ≥5/24	27.5*	40.1†	33.1†	<0.001
Mean rate of lungs scored ≥10/24	10.2*	17.2†	14.6†	<0.001

*†‡Values with different symbols in a row differ significantly. *P*-values are given to indicate a difference between the 3 groups. They do not indicate the difference between 2 groups.

CONCLUSION

This survey is not a prevalence study but gives an interesting view of respiratory importance in herds. Despite the large use of mycoplasma vaccine, respiratory diseases have not completely disappeared. This demonstrates that veterinarians and farmers must still pay attention to this topic. It is particularly important to target the risk factors of respiratory diseases in the farms. Considering the number of examined lungs, this is by far the most important study ever made on this topic.

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