

An Abattoir Survey of the Incidence of Pneumonia in Saskatchewan Swine and an Investigation of the Microbiology of Affected Lungs

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SUMMARY

The lungs of 15 409 pigs, mostly from Saskatchewan, slaughtered at an abattoir were examined over a one year period. The incidence of lesions was 36.7% for "enzootic" pneumonia and 2.1% for pleurisy unassociated with pneumonia. Seasonal variations were recorded and compared with the results of similar surveys carried out in Australia, Belgium and England. Mycoplasmological examination of lungs from 347 animals was consistently negative for *Mycoplasma hyopneumoniae*. *Pasteurella multocida* was the commonest bacterial isolate, a result which agrees with those of other workers.

RÉSUMÉ

Un relevé sur l'incidence de la pneumonie, chez les porcs de la Saskatchewan, dans un abattoir, et une étude microbiologique des poumons affectés
Cette étude consistait à examiner, dans un abattoir de la Saskatchewan, au cours d'une période de 12 mois, les poumons de 15,409 porcs, dont la plupart originaient de cette province. On décéla des lésions de pneumonie enzootique, chez 36.7% de ces porcs, et des lésions de pleurésie sans pneumonie, chez 2.1% d'entre eux. On enregistra des variations saisonnières et on compara les résultats avec ceux de relevés similaires, effectués en Australie, en Belgique et en Angleterre. La recherche de *Mycoplasma hyopneumoniae*, dans les poumons de 347 porcs, s'avéra constamment négative. *Pasteurella multocida* représentait la bactérie isolée le plus souvent; ce résultat concordait avec celui d'autres chercheurs.

INTRODUCTION

Pneumonia is an occasional cause of

death in pigs of all ages and pneumonic lesions are found in a significant proportion of slaughtered pigs. In a survey carried out in New South Wales, Australia (3) lesions of pneumonia, mainly "enzootic pneumonia", were detected in 19.1% of lungs from 960 pigs. A higher incidence was observed during the summer months (April to March) than in the fall months (April to June). A similar survey carried out in southwestern England (10) recorded a much higher incidence (40.7% of 9 367 pigs) but with less seasonal variation that ranged from a high of 50.5% in the spring (April to June) to a low of 35.4% in the fall (October to December). In a report from Belgium (2) pneumonic lesions were found in 57% of 17 581 pigs and although seasonal breakdown was not fully detailed the authors indicated that lesions were more frequently observed in the spring months. A Dutch survey cited by the same authors (2) noted an incidence of pneumonia that ranged from 21.4 to 37.9% of 25 418 pigs.

Pleurisy, alone or associated with pneumonia, was seen in the above reports (2,3,10). In Australia the incidence of pleurisy was 3.8%, the lowest being in the fall. In England the incidence was almost twice as high (7.0%) but there was much less seasonal variation. The Belgian study recorded the highest incidence of pleurisy (14.0%) of which 10% were associated with pneumonia.

In an analysis of lesions in pigs necropsied at the University of Bern in the period 1971-73 (4), "enzootic pneumonia" was reported in 4.5% of pigs from specific pathogen free (SPF) farms, in 10.3% of pigs from farms in the Swedish husbandry system and in 11.4% of pigs from farms not on the

Swedish health system. Death from pneumonia was most frequent during the winter months and least frequent during the spring and summer months.

Cultural examination of lungs was not carried out in the Australian, British, Belgian or Dutch surveys (2,3,10). However, the results of cultural examinations of lungs have been recorded by many authors with a wide divergence in the percentage of apparently normal lungs which yielded *Pasteurella multocida*. Two groups (6,9) failed to isolate the organism from 15 and 20 sets of lungs respectively. In four other studies (5,7,8,13) *P. multocida* was isolated from 23 of 100, 13 (26%) of 50, 7 (37%) of 19 and four of 100 sets of lungs respectively.

In contrast, in investigations of the bacterial flora of pneumonic lungs the isolation rate for *P. multocida* ranged from 27%(14) through 54%(13) to a high of 58%(11). In a more detailed study in England (12) *P. multocida* was isolated from only 28(34.2%) of 82 lungs with a mild pneumonia as compared to 19(65.5%) of 29 lungs with severe pneumonia thus suggesting that these bacteria were stimulating an inflammatory response. In a Canadian study (6) *P. multocida* was found in 40.7% of pneumonic lungs while *Mycoplasma hyorhinis* was present in 51.1%. In a Swiss study (4) *P. multocida* was isolated in pure culture from 122(17.8%) of 685 lungs showing lesions of "enzootic pneumonia", while *Haemophilus suis* was isolated from 45(6.6%) *Streptococcus* sp. from 24(3.5%), *Bordetella bronchiseptica* from 16(2.3%) and a mixed flora from 45(6.6%). *Haemophilus parahaemolyticus* (*pleuropneumoniae*) was isolated from eight (1.2%) of the 685 lungs with "enzootic pneumonia". *Haemophilus parahaemolyticus* was the most signifi-

icant isolate from lungs with lesions of "bacterial pneumonia" (nonenzootic type). This organism was not isolated from pigs on SPF farms but was present in 1.2% of farms on the Swedish husbandry system and in 8.9% of farms not on this system. *Streptococci* and *B. bronchiseptica* were very much less frequently encountered and *Corynebacterium pyogenes* and *Actinobacillus lignieresii* were rarely encountered in "bacterial pneumonia".

In the course of an investigation on the incidence of *H. pleuropneumoniae* infections in pigs slaughtered in Saskatchewan, details of all lesions of pneumonia and pleurisy found in the carcasses were recorded.

MATERIALS AND METHODS

Lesion Survey — Visits were made throughout the period February, 1978 to January, 1979 inclusive to the largest packing plant in Saskatchewan where swine are slaughtered from all parts of the province. Since some producers regularly send animals for slaughter on the same day of the week, visits were made on different days and at different times of the day. A minimum of three visits per month were made.

Lungs were examined after removal from the carcass and lesions recorded for each of the seven lobes. The extent of involvement of the lesions showing grey or red colored consolidation suggestive of the condition commonly referred to as "enzootic pneumonia" were graded on a scale of diminishing severity +++, ++, + or trace. Evidence of pleurisy and the presence of lesions of serositis involving the pericardium and abdominal organs were also noted. All lungs with macroscopical lesions suggestive of infection by *H. pleuropneumoniae*, that is fibrinous pleurisy overlying an area of consolidation and severe congestion, were collected for culture. Also collected were representative samples of lungs with lesions suggestive of "enzootic pneumonia", purulent pneumonia, lung abscess, pyaemia and other conditions. Representative normal lungs were also taken for examination.

Bacteriological Examination — This was carried out within three hours of collection of samples. Portions (approximately 1 cm³) of normal and

TABLE I
MONTHLY INCIDENCE OF LESIONS OF "ENZOOTIC" PNEUMONIA AND OTHER PULMONARY LESIONS IN SASKATCHEWAN SWINE

	Total lungs examined	Enzootic Pneumonia (%)	Pleurisy with EP	Pleurisy without EP	<i>Haemophilus</i> Pneumonia
1978 Feb.	2104	479 (22.7)	6 (0.3)	24 (1.2)	
Mar.	2179	711 (32.7)	8 (0.4)	30 (1.4)	
Apr.	869	363 (41.8)	4 (0.5)	18 (2.1)	1
May	1230	486 (39.5)	12 (1.0)	30 (2.4)	2
June	1414	589 (41.5)	16 (1.2)	15 (1.1)	
July	932	316 (33.9)	4 (0.4)	28 (3.0)	2
Aug.	1097	375 (34.2)	7 (0.7)	31 (2.8)	
Sept.	1202	460 (38.2)	12 (1.0)	29 (2.4)	
Oct.	1101	336 (30.5)	6 (0.6)	56 (5.1)	
Nov.	1077	592 (55.0)	7 (0.7)	16 (1.5)	
Dec.	1051	491 (46.5)	16 (1.5)	27 (2.6)	
1979 Jan.	1162	461 (39.6)	9 (0.8)	18 (1.6)	
	15409	5659 (36.7)	107 (0.7)	322 (2.1)	

() = % of total number examined

pneumonic lungs were taken and ground in a tissue grinder. Swabs from the emulsion thus produced were plated onto 5% sheep blood agar which was cross-streaked with a β haemolytic staphylococcus. Incubation was carried out in a candle jar. A swab of ground material was also inoculated onto a Hayflick's medium plate and into Hayflick's broth containing 15% porcine serum. Examination of the plate for suspect *Mycoplasma* colonies was made at two-day intervals up to eight days. Subcultures from the broth were made every two days for six days and the subcultures examined as for primary plates.

Histopathological Examination — Portions of tissue (approximately 3 x 2 x 1 cm) adjacent to those which were taken for culture were placed in 10% formol saline for processing for histopathological examination. Sections were stained by hematoxylin and eosin and, if indicated, by Brown and Brenn's stain for Gram-positive and Gram-negative bacteria.

RESULTS

Lesions — Of a total of 15 409 sets of lungs examined, 9 316 (60.5%) were judged to be normal, 5 659 (36.7%) had lesions of pneumonia involving the anteroventral areas in grey or red colored consolidation and 322 (2.1%)

had lesions of pleurisy unassociated with pneumonia. Monthly and quarterly statistics are given in Tables I and II. The incidence of lesions in various lobes of the lungs is given in Figure 1 in which a comparison is made with results described for Australia, Belgium and a small survey carried out in eastern England (1). Lesions were most common in cardiac lobes with a moderate incidence in apical lobes particularly the right which has an accessory bronchus. Lesions in the intermediate and diaphragmatic lobes were much less common.

TABLE II
QUARTERLY INCIDENCE OF LESIONS OF "ENZOOTIC" PNEUMONIA AND PLEURISY RECORDED IN SURVEYS OF PIGS SLAUGHTERED IN DIFFERENT COUNTRIES

Season	Enzootic Pneumonia %			Pleurisy %		
	a	b	c	a	b	c
Winter ^a	41.5	16.0	31.2	6.9	4.1	1.4
Spring	50.5	20.4	41.0	8.0	4.0	1.9
Summer	36.2	26.3	35.5	7.0	6.0	2.7
Autumn	35.4	12.4	45.0	6.2	0.8	3.0
Overall	40.7	19.1	36.7	7.0	3.8	2.1

^aWinter — Jan.-March: Northern Hemisphere
July-Sept.: Southern Hemisphere

a: southwest England (10)

b: New South Wales, Australia (3)

c: Saskatchewan, Canada

Cultural Examination — The results of bacteriological examination are shown in Table III. *P. multocida* was the organism most frequently isolated; *M. hyopneumoniae* was not isolated. In this survey only five lungs contained lesions that were positive for *H. pleuropneumoniae*.

Histopathological Examination — Only one specimen other than the five from which *H. pleuropneumoniae* was cultured showed lesions strongly suggestive of infection by this organism. Several lungs had focal lesions of

hemorrhage beneath areas of fibrinous pleurisy which resembled grossly the lesions of pleuropneumonia. Microscopically, these were shown to be areas of very recent hemorrhage probably a result of electrical stunning.

DISCUSSION

The overall incidence of lesions of pneumonia involving anteroventral areas of the lung did not differ greatly from that described in southwestern England but was much lower than that described for Belgium and was much

higher than figures for New South Wales. This is somewhat surprising since the climates of England and Belgium are more similar than those of Belgium and the Canadian prairies. However, the higher incidence in diaphragmatic lobes in European pigs suggests a possible predisposing factor to further spread of infective agents in this geographic area. On the other hand heavily stocked pig houses in any part of the world may have an internal climate suited to spread of respiratory disease which differs little in areas of the same latitude. An even wider divergence of incidence was seen when figures for Australia were compared with those for the northern hemisphere. This might be related to milder winter conditions and/or differences in pig husbandry in New South Wales. The very low incidence of lesions of *H. pleuropneumoniae* infection in Saskatchewan was not surprising as reports of outbreaks of this condition resulting in fatalities are rare in the area serviced by the Western College of Veterinary Medicine.

The frequency of isolation of *P. multocida* from macroscopically normal lungs was about the mid-range of those reported in the literature. If one takes only completely normal lungs the figure was 16% but if we assume lungs with hemorrhage associated with electrical stunning to be normal the figure would reach 20%. The possibility that inhalation of water in the scalding tank occurred and washed some of the nasal flora into the lungs cannot be excluded.

The frequency of isolation of *P. multocida* (105/191 or 55%) from lungs with lesions of low-grade pneumonia was as high as the majority of other reports and higher than that described in a large scale necropsy survey (4). The incidence is significantly different from that found in normal lungs but whether *P. multocida* was a primary or secondary invader is difficult to say. The absence of *M. hyopneumoniae* is probably not significant in view of the fact that no special measures were taken to enhance the growth of *M. hyopneumoniae* or prevent the growth of *M. hyorhinis*. Since most of the animals were six to seven months old, it is possible that mycoplasmas initiated lung damage but were eliminated following infection or were very

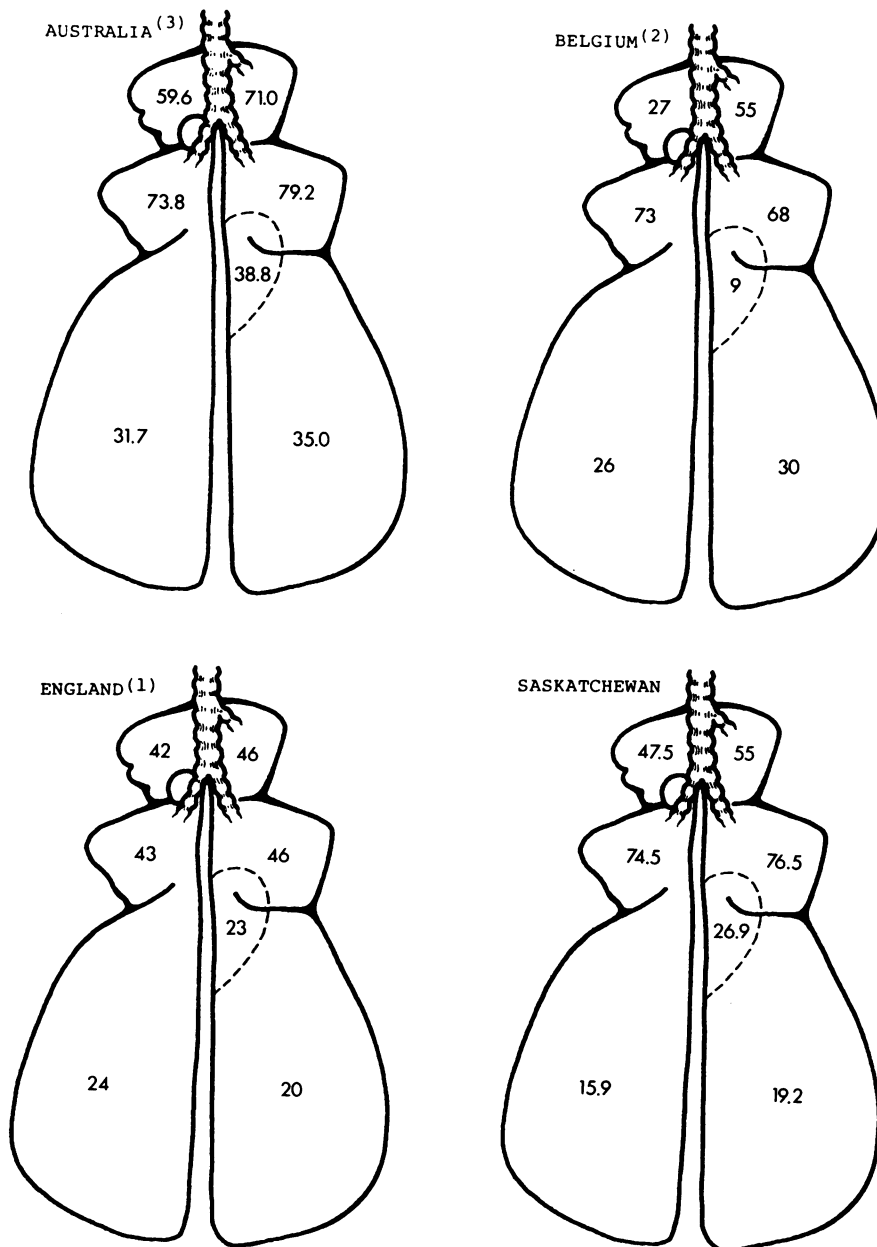


FIGURE 1. Diagrammatic representation of different proportional incidence of lesions of "enzootic" pneumonia in various lobes of the lungs of pigs as recorded in different surveys.

TABLE III
MICROBIOLOGICAL FINDINGS IN 347 PAIRS OF PORCINE LUNGS, EITHER NORMAL OR DISEASED

Organisms ^a	Macroscopical Abnormality of Lung						
	Normal (25)	"Enzootic" Pneumonia (191)	Pyæmia (5)	Abscess (10)	Pleuropneumonia (6)	Pleurisy (19)	Other ^b (91)
<i>P. multocida</i>	4	105		2	1	4	19
<i>C. pyogenes</i>		7 (+4 ^c)	5	10		4	
<i>H. parahaemolyticus</i>					5		
<i>M. hyorhinis</i>	1	19 ^d		1		3	
<i>M. arginini</i>		2 ^d					
<i>M. spp.</i>		2					
<i>Mycoplasma</i> isolated but died on subculture		11					1
α Streptococci	9	31					
β Streptococci	5	10					
<i>E. coli</i> or coliform	15	26					
Staphylococci	8						
Other							1 (<i>F. necrophorum</i>)

() Number of lungs cultured

^aTwo or occasionally three organisms present in many cases

^bThe majority of these were essentially normal lungs showing hemorrhage resulting from electrical stunning

^cPurulent pneumonia probably originally "enzootic"

^dTwo mycoplasmas from same lung

considerably reduced in numbers by the time the animals were slaughtered, whilst other bacteria maintained an inflammatory response.

It is interesting to note the lower incidence of pleurisy unassociated with pneumonia in Saskatchewan swine as compared with English or Australian pigs. This appears to be associated with a very low incidence of polyserositis. This condition often demands stripping of the pleura from the carcass but, like uncomplicated pneumonia, does not lead to a significant condemnation of meat. The economic impact of the conditions reported is unlikely to be of significance as far as the final carcass is concerned but either condition may have caused a reduction in the rate of weight gain. Overall the incidence of severe inflammatory conditions of the thoracic viscera was rare which means that financial implications of pulmonary conditions can only be assessed by a close investigation of daily weight gains as compared with performance in SPF herds.

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