Vaccination Against Pleuropneumonia of Pigs Caused by *Haemophilus pleuropneumoniae*

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SUMMARY

A strain of *Haemophilus pleuropneumoniae* was isolated from a pig with pleuropneumonia from a herd where this condition was frequent. A formalin inactivated culture of this isolate was used as antigen in two vaccine preparations: A and B. Vaccine A had peanut oil + arlacel 80 + tween 80 as adjuvant and vaccine B had aluminum hydroxide gel as adjuvant. Twenty pigs were vaccinated twice with vaccine A and 19 with vaccine B. Twenty additional pigs were not vaccinated. All pigs were transferred to the herd. Eleven pigs in the nonvaccinated group developed pneumonia and seven of these died within eight days after exposure. None of the vaccinated pigs had signs of pneumonia. It is concluded that the vaccines prevented the acute form of pleuropneumonia due to *H. pleuropneumoniae*.

RÉSUMÉ

Vaccination contre la pleuropneumonie porcine attribuable à *Haemophilus pleuropneumoniae*

Les auteurs ont isolé *Haemophilus pleuropneumoniae*, chez un porc qui souffrait de pleuro-pneumonie et qui appartenait à un troupeau où cette condition sévissait fréquemment. Ils utilisèrent une culture formolée de cette souche, pour préparer deux vaccins. Le vaccin A contenait, à titre d'adjuvants, les substances suivantes: huile d'arachides, arlacel 80 et tween 80; l'hydroxyde d'aluminium constituait par ailleurs le seul adjuvant du vaccin B. Vingt porcs reçurent deux injections du vaccin A et 19, deux injections du vaccin B. Vingt autres porcs servirent de témoins. On transporta ensuite tous ces porcs, au sein du troupeau. Onze témoins développèrent de la pneumonie, et sept d'entre eux en moururent, en l'espace de huit jours. Aucun des porcs vaccinés ne manifesta de signes de pneumonie. Les auteurs en conclurent que leurs deux vaccins réussirent à prévenir la forme aiguë de la pleuro-pneumonie imputable à *H. pleuropneumoniae*.

INTRODUCTION

Pleuropneumonia of swine caused by *Haemophilus pleuropneumoniae* is a serious threat to the modern industry. The disease occurs in an acute and a chronic form. During outbreaks of acute disease the mortality can reach 100% among piglets and 25% among feeder pigs (1). The chronic form, characterized by pleuritis and localized pulmonary necrosis, decreases growth rate and increases production cost. Attempts to control pleuropneumonia may be based on vaccination or serological diagnosis followed by elimination of reactors. Pigs recovered from infection are immune (2,6).

The purpose of this study was to evaluate under field conditions the protective effect of two vaccines differing in their adjuvants.

MATERIALS AND METHODS

Strain CM5 of *Haemophilus pleuropneumoniae* was isolated from a pig in a herd where pleuropneumonia was chronic. The strain was grown overnight in diphasic culture of trypticase soy agar and broth with 0.1% NAD.[1] Formaldehyde to a final concentration of 0.2% was added to the culture, which was then heated to 60° C for two hours. Before inactivation the number of colony forming units per mL was 10^9 as determined by plate counting on blood agar containing 0.1% NAD. Sterility of the inactivated culture was ascertained by spreading 0.1 mL over a blood agar plate containing NAD. Two vaccines were prepared by varying the adjuvant. Vaccine A contained two parts inactivated culture, plus one part peanut oil,[2] arlacel 80,[3] tween 80[4] adjuvant (5). Vaccine B contained two parts inactivated culture plus one part aluminum hydroxide[5] adjuvant.

Sixty pleuropneumonia-free Yorkshire pigs of approximately 30 kg body weight were divided into three groups of 20 each. Each pig of group I was given 5 mL of vaccine A subcutaneously behind the ear. Pigs of group II were given vaccine B similarly and group III was the nonvaccinated control. Two weeks later the dose was repeated. After another two days all pigs were transferred to the herd where the isolate originated and placed in one pen together with 15 resident pigs which all had shown signs of acute pleuropneumonia. The experimental pigs were observed for four weeks after contact exposure and all pigs dying were submitted for necropsy and the lungs were cultured on blood agar with NAD.

RESULTS

Within ten to 30 minutes after the initial vaccination the pigs became prostrated and a few vomited. This

[1]Nicotinamide adenine dinucleotide, Eastman Kodak Co., Rochester, New York.
[2]Planters Peanut Oil, Standard Brands Canada Ltd., Toronto, Ontario.
[3]Atlas Chemical Industries, Brantford, Ontario.
[4]Fisher Scientific Comp., FairLawn, New Jersey.
[5]Wyeth Laboratories, Philadelphia, Pennsylvania.

was not observed after the second dose. Most of the pigs given vaccine A developed subcutaneous nodules of approximately 2-3 cm diameter at the site of injection. One pig from group II that died five days after the initial vaccination had intraperitoneal hemorrhage presumably from trauma. In the period from four to eight days after the pigs were transferred to the herd, 11 pigs from group III developed signs of pneumonia, including high fever, dyspnea and occasional coughing (Table I). Seven pigs died. They had extensive bilateral fibrinous hemorrhagic pleuropneumonia with 1-2 L of serohemorrhagic fluid in the pleural cavities. The submandibular lymph nodes were enlarged, hemorrhagic and edematous. Two pigs had additional pericarditis. Large numbers of *H. pleuropneumoniae* in pure culture were isolated from the lungs of all dead pigs. None of the pigs in groups I or II died or showed signs of pneumonia.

TABLE I
RESULTS OF CONTACT EXPOSURE OF VACCINATED AND NONVACCINATED PIGS TO PIGS CHRONICALLY INFECTED WITH *H. PLEUROPNEUMONIAE*

	Group I	Group II	Group III
Pigs in group	20	19	20
Vaccine	A[a]	B[b]	—
Morbidity	0	0	11
Mortality	0	0	7

[a]Two parts inactivated *H. pleuropneumoniae*, strain CM5 and one part peanut oil, arlacel 80, tween 80 adjuvant (6).
[b]Two parts inactivated *H. pleuropneumoniae*, strain CM5 and one part aluminum hydroxide adjuvant (6).

DISCUSSION

Sterile supernatants or sonicated bacteria from cultures of *H. pleuropneumoniae* can induce acute localized lesions similar to the spontaneous disease when inoculated endobronchially (4). This indicates that toxic factors produced during growth play a role in disease. Sterile supernatants and viable bacteria are highly toxic for porcine pulmonary macrophages. This toxicity can be neutralized by serum from pigs recovered from spontaneous disease (Bendixen, Shewen, Rosendal and Wilkie to be published). The immune response after vaccination may also neutralize this toxicity. Our vaccines seemed toxic because the pigs became prostrated and some vomited after the initial vaccination. We feel that it may be important, at least until more is known about protective antigens, to use whole inactivated cultures in the vaccines rather than washed suspensions, as the former may contain higher concentrations of antigens eliciting immune response against toxins than the latter.

Nielsen (3) prepared vaccines on the basis of formalin inactivated suspensions of bacteria from plate cultures. The best one protected 17 of 19 pigs against disease, but only seven against persistent infection, when the pigs were challenged with an aerosol of bacteria.

In this field experiment, vaccination with either vaccine A or B prevented the acute form of pleuropneumonia. It is not known at this point in time whether the vaccines prevented the chronic form or infection as well.

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BOOK REVIEW

The Care and Management of Farm Animals. Edited by W.N. Scott. Published by Collier Macmillan Canada, Ltd., Cambridge, Ontario. 1978. 254 pages. Price $24.95.

This book, the result of the work of ten individual contributors, might be a source of information for city dwellers. It may also apply to the type of agriculture practised in the British Isles. However, it is completely out of date for Canadian readers. Furthermore, much of the information given is very elementary and would cause a stockman to smile . . .

The text is studded throughout with unexplained statements, some of which are right sybilline: "The placenta helps to maintain pregnancy in sheep but not in goats . . . " is a fair example.

At other times, we have a mixture of simplicity and technics which makes us wonder for whom the book has been intended.

The husbandry system advocated is backwards: rearing pigs on pasture may provide a nice sight but does not seem to be economically oriented.

The main problem of this book is perhaps that the topics covered are too varied. It reviews all stages of dairying, treats of rabbit raising etc. There is even a chapter on water buffalo husbandry, which does not seem to fit with the rest of the book.

Overall, this is a mixed book, practically from cover to cover. *C. Gardell.*