Swine Influenza Virus Passive Antibody Levels in Pigs from Vaccinated or Nonvaccinated Sows

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Summary and Implications

Swine influenza virus passive antibody levels were measured in pigs from vaccinated vs. nonvaccinated dams. Pigs from vaccinated dams had significantly higher passive antibody titers compared with pigs from nonvaccinated dams. In pigs from nonvaccinated sows, titers >20 were not detected by 8 weeks of age. In pigs from vaccinated dams, titers >20 were no longer detected at 16 weeks of age. The persistence of passive antibodies may protect young pigs from SIV but also could inhibit immune responses to vaccination.

Introduction

Recently, a killed virus, adjuvanted vaccine for swine influenza virus (SIV) has become available for commercial use. The vaccine has been shown to be effective against experimental challenge and field experiences have been positive(1). The pattern of SIV infections in swine herds appears to be changing from sporadic outbreaks to endemic disease in young pigs (suckling or nursery) and finishing pigs. Vaccination of dams prior to farrowing appears to control the endemic disease in young pigs, apparently by increasing the level of colostral immunity. However, increasing the level of colostral immunity with other diseases such as pseudorabies virus has been shown to reduce the immune responsiveness of pigs to vaccination until the colostral immunity has declined(2). The purpose of this experiment was to determine the passive antibody levels in pigs from vaccinated vs. nonvaccinated sows.

Materials and Methods

A total of 38 pigs from eight vaccinated and four nonvaccinated sows was used. The herd had experienced a clinical outbreak of SIV 1 year before so the immunity in the sows at the start of the experiment was due to natural infection. Sows were vaccinated 2 and 5 weeks prior to farrowing and blood was collected just prior to farrowing. All pigs were bled at 2 days of age and 38 were randomly selected and tagged. Blood was collected from the selected pigs at 2, 4, 6, 8, 12, 16, and 20 weeks of age. Five pigs from vaccinated sows were sold just prior to the 20 week blood collection.

Sera were tested for SIV antibodies by hemagglutination inhibition (HI) using a standard procedure. All samples were tested in duplicate. The highest dilution measured was 1:640. The results are reported as the reciprocal of the highest dilution that inhibited hemagglutination. Negative titers are reported as <10. Geometric mean titers were calculated using a dilution of 1:5 as the starting point. Data were analyzed using non-parametric statistical tests; Chi square on the proportions of seropositive pigs and Kruskal-Wallis ANOVA on titer data.

Results and Discussion

The SIV titers of the sows at farrowing ranged from 160 to >640 in the vaccinated sows and from <10 to 40 in the nonvaccinated sows. The SIV titers in the pigs are presented in Table 1. The titers in pigs from vaccinated dams and/or the percentage of seropositive pigs were higher at all ages except at 20 weeks of age. The high levels of passive antibodies in pigs from vaccinated dams provides an explanation for the apparent effectiveness observed under field conditions of vaccinating sows prior to farrowing to control SIV disease in suckling and nursery pigs.

Conversely, the persistence of passive antibodies may inhibit immune responses to vaccination in young pigs. Typically, SIV vaccination for controlling disease in finishing pigs is done during the nursery phase. Assuming two injections 2–3 weeks apart, pigs are 10–11 weeks old when leaving the nursery and at least 1-week lead time before exposure, pigs would be 6–7 weeks old at the first injection and 8–10 weeks old at the second injection. The vaccine manufacturer has expressed concern about vaccine effectiveness in pigs with passive antibody titers >40. In this experiment, the number of pigs from vaccinated sows with titers >40 by age was 23 of 23 at 2 weeks, 23 of 23 at 4 weeks, 22 of 23 at 6 weeks, 16 of 23 at 8 weeks, and 10 of 23 at 12 weeks.

The vaccination strategy for controlling SIV will vary from herd to herd. Our data suggest that evaluating the antibody levels in the dams and their offspring is needed to help determine what approaches are feasible.

References

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Table 1.Swine influenza virus passive antibody levels in pigs from vaccinated or nonvaccinated sows.

Sow Vacc. status	Age in weeks	No. of pigs	Mean titer	No. of pigs with titer <10	10	20	40	80	160	320	640
Yes	0	23	640	0	0	0	0	0	0	0	23
No	0	15	201	0	0	2	1	1	4	0	7
Yes	2	23	542	0	0	0	0	0	1	5	17
No	2	15	58	1	1	2	3	4	3	1	0
Yes	4	23	373	0	0	0	0	1	7	4	11
No	4	15	26	3	2	2	5	3	0	0	0
Yes	6	23	132	0	0	1	5	3	9	5	0
No	6	15	11	5	5	4	1	0	0	0	0
Yes	8	23	57	1	0	6	6	3	7	0	0
No	8	15	6	14	1	0	0	0	0	0	0
Yes	12	23	21	5	6	2	6	4	0	0	0
No	12	15	<10	15	0	0	0	0	0	0	0
Yes	16	23	11	17	4	2	0	0	0	0	0
No	16	15	<10	15	0	0	0	0	0	0	0
Yes	20	18	<10	18	0	0	0	0	0	0	0
No	20	15	6	14	0	0	0	1	0	0	0

Influence of Passive Immunity on Serological Responses to *Mycoplasma hyopneumoniae* Vaccination

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Summary and Implications

Vaccine-induced serum antibody levels were significantly less in pigs with passive immunity to Mycoplasma hyopneumoniae compared with pigs without passive immunity. Age at vaccination did not influence antibody responses to vaccination. The presence of passive antibodies at the time of vaccination may provide an explanation for vaccination failure under field conditions.

Introduction

Vaccination failure under field conditions can be due to a number of reasons, including poor injection technique, relative immune suppression due to stress or age at vaccination, and short duration of immunity. Age at vaccination for M. hyopneumoniae did not influence the level of protection against experimental challenge in a previous study conducted in our laboratory (1). Unfortunately, the duration of immunity following vaccination is not routinely evaluated for licensing vaccines. The presence of passive immunity at the time of vaccination can reduce vaccine effectiveness. Reduction or complete blockage of immune responses to vaccination in the presence of passive immunity has been documented for several swine diseases, including pseudorabies virus and Actinobacillus pleuropneumoniae (2,3). The half-life decay of M. hyopneumoniae passive antibodies was 15.8 days in one study (4). However, there is very little survey information on the levels of M.hyopneumoniae antibodies in sows. The purpose of this experiment was to determine if passive antibodies inhibit the immune response to vaccination.

Materials and Methods

Pigs from a commercial herd were used for this study. Sows were vaccinated or not vaccinated at 2 and 5 weeks prior to farrowing with a double dose of a commercially available M. hyopneumoniae vaccine (Respisure, Pfizer Animal Health). Seven days after farrowing, pigs were selected, weighed, tagged, and moved to an isolated facility. Blood was collected from the sows at the same time. The pigs were allotted to three groups, balancing for litter, sex, and weight. Group 1 was vaccinated at 11–15 and 25–29 days of age. Group 2 was vaccinated at 25–29 and 39–43 days of age.

Group 3 served as controls. The same vaccine administered to the sows was used for the pigs. Injections were administered intramuscularly in the neck. Pigs from vaccinated and nonvaccinated sows were included in each vaccine group. Blood was collected from the pigs at 11–15 days of age, at each vaccination and 2 weeks after the second vaccination. Response to vaccination was based on ELISA optical density (OD) values at 2 weeks after the second vaccination (5). Statistical analysis was done by ANOVA.

Results and Discussion

The average OD value of sows at farrowing was .950 (range of .419 to 1.296) for the vaccinated sows and .193 (range of .119 to .245) for the nonvaccinated sows. The ELISA OD values in the pigs are presented in Table 1. With our ELISA, an OD value of <.200 is usually considered to be negative. Pigs from nonvaccinated sows had essentially no passive antibodies. Their response to vaccination was consistent with previous studies and was not influenced by the age at vaccination.

In pigs from vaccinated sows, all pigs had high levels of passive immunity and the decline in antibody levels in Group 3 pigs (not vaccinated), was similar to a previous study. The serum antibody responses in the vaccinated pigs were difficult to interpret because of the presence of high levels of passive antibody in addition to the antibody induced by vaccination. However, it appears that the amount of antibody induced by vaccination is reduced when pigs were passively immune at the time of vaccination. Vaccination apparently induced serum antibodies as both Groups 1 and 2 had higher OD values 2 weeks after vaccination compared with control pigs from vaccinated dams. Conversely, the OD values in Group 2 pigs from vaccinated dams was significantly less than Group 2 pigs from nonvaccinated dams. Unfortunately, the pigs were not tested later on when the passive antibody levels in Group 3 pigs from vaccinated sows would have declined to lower levels, which would have allowed for a more direct evaluation of vaccine-induced antibody levels. Also, the influence of passive immunity on the level of protection after vaccination needs to be addressed either via experimental challenge and/or field studies.

References

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Table 1.Mycoplasma hyopneumoniae antibody levels as measured by ELISA in vaccinated pigs with or without passive immunity at the time of vaccination.

Age in days	Vacc. group	No. of pigs	ELISA OD values in vaccinated pigs by the vaccination status of the dam	
			Vaccinated	Not Vaccinated
11–15	1	12	.860 + .361	.073 + .051
	2	14	.807 + .345	.066 + .038
	3	11	.994 + .136	.079 + .049
25–29	1	12	.590 + .344	.060 + .036
	2	13	.523 + .256	.036 + .013
	3	11	.660 + .180	.042 + .023
39–43	1	12	.649 + .312	.706 + .278
	2	13	.296 + .180	.055 + .034
	3	11	.394 + .187	.047 + .041
53–57	2	13	.515 + .135	.734 + .306
	3	11	.234 + .093	.072 + .044