

Antibody Responses of Vaccinated and Nonvaccinated Calves to *Haemophilus somnus*

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Summary

Respiratory disease resulting from infection of calves with *Haemophilus somnus* (*H. somnus*) is an annual occurrence in fall calves at the McNay Farm. Previous observations of skin test reactivity to *H. somnus* antigens suggested a role for this phenomenon in the pathogenesis of the disease. Groups of calves, about 90 days of age, were vaccinated with four different commercial *H. somnus* vaccines, and serum levels of *H. somnus* antibodies were determined. Antibodies of the IgG and IgE classes were detected with ELISA procedures conducted on sera collected before and after vaccination. Most of the calves had detectable *H. somnus* IgE class antibodies at the start of the experimentation but IgG class antibodies were minimal. Antibodies of both classes increased in nonvaccinated and vaccinated calves during the 30 day period of experimentation. However, the level of IgE class antibodies in vaccinates was lower than in controls suggesting that vaccination may limit the IgE response.

Introduction

There is gradually accumulating evidence that bacterial infection can lead to specific IgE antibody responses that may contribute to immediate hypersensitivity reactions. *Bordetella pertussis* has been recognized as an allergen for a long time, but more recently agents such as *Pasteurella haemolytica*, *Escherichia coli*, *Salmonella enteritidis*, *Staphylococcus aureus*, *Streptococcus sp.*, *Borrelia burgdorferi*, *Brucella abortus*, and *Neisseria flavescens* have demonstrated ability to induce IgE responses. *Bordetella pertussis* and *Neisseria flavescens* have been associated with respiratory allergy in man.

The character and chronicity of disease caused by *Haemophilus somnus* (*H. somnus*) in calves led us to skin test calves with extracts of *H. somnus* organisms. Intradermal administration of these antigens induced wheal and flare reactions typical of immediate hypersensitivity. There is also anecdotal information that administration of *H. somnus* vaccines contributes to clinical respiratory disease. Some of the commercial vaccines contain aluminum hydroxide as an adjuvant and this material has demonstrated

ability to facilitate IgE antibody responses in rats. Therefore, the objective of this experimentation was to evaluate antibody responses in calves administered several different commercial *H. somnus* vaccines.

Materials and Methods

Animals utilized for this study were heifer calves born in August and September, 1997, at the McNay Farm. These calves were weaned in mid-November and placed in a dry lot on a grain and hay ration. The calves were randomly assigned to one of five experimental groups on November 24, bled for serum, and vaccinated as follows:

Group A- Vaccine A

Group B- Vaccine B

Group C- Vaccine C

Group D- Vaccine D

Group E- Controls, no vaccination

Vaccination was according to the protocol recommended by the manufacturer. Calves were bled again on December 10, 17 and 22. Serum was harvested and stored at -20°C until tested.

Sera were tested for specific anti- *H. somnus* antibodies with ELISA procedures. The *H. somnus* antigen was a washed whole cell preparation of the bacteria cultured in broth medium. For detection of IgE antibodies a mouse monoclonal antibody specific for bovine IgE and a peroxidase-labeled anti-mouse Ig was utilized. IgG class antibodies were detected with a peroxidase-labeled anti-bovine Ig reagent. Positive and negative sera were included in each test microtiter plate at the same dilution as test sera and utilized to calculate reported values by the following formula:

$$\text{Percentage of Standard} = \frac{\text{Mean O.D test} - \text{mean O.D negative}}{\text{Mean O.D positive} - \text{mean O.D negative}}$$

Results and Discussion

Antibody levels to *H. somnus* in sera of the calves prior to and after vaccination are provided in Tables 1 and 2.

Table 1. Mean anti-*H. somnus* IgG antibody levels in groups of vaccinated or nonvaccinated calves.

Group	Date			
	11/24	12/10	12/17	12/22
A	17.5	91.0	147.7	161.6
B	4.0	72.2	119.6	125.4
C	27.7	84.3	121.8	238.4
D	9.5	91.7	124.0	119.6
E	11.2	129.6	123.4	151.4

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Table 2. Mean anti-*H. somnus* IgE antibody levels in groups of vaccinated or non-vaccinated calves.

Group	Date			
	11/24	12/10	12/17	12/22
A	56.3	101.0	115.9	157.9
B	68.2	83.3	107.4	134.9
C	80.4	115.1	119.8	136.0
D	54.7	78.4	99.5	114.5
E	65.8	130.7	131.5	206.9

Clinical respiratory disease with the involvement of *H. somnus* bacteria is an annual occurrence in fall calves at the McNay Farm. These calves are usually weaned at about 90 days of age, and respiratory disease expressed by coughing and a nasal discharge is observed for several weeks thereafter. On occasion the disease progresses to a severe pneumonia with death unless promptly treated. *H. somnus* is routinely isolated from calves at necropsy unless they had prolonged antibiotic treatment.

Infection with the bacteria apparently develops relatively early inasmuch as IgE antibodies were detectable in the sera of all the calves at the beginning of the experiment. The level of these antibodies continued to rise during the next 30 days in all groups although levels in vaccinated animals were lower than in the nonvaccinated controls. This was particularly evident in Group D calves.

Thus, it was apparent that vaccination may have a suppressing effect on IgE responses.

In contrast, many calves did not have detectable IgG anti-*H. somnus* antibodies at the start of the experimentation and mean levels were very low. IgG antibody levels increased during the next 30 days but only vaccinated Group C developed higher levels than the nonvaccinated control calves.

It is apparent that the early antibody response to *H. somnus* infection of the respiratory tract is of the IgE class. Presence of appreciable levels of these antibodies in the serum would suggest that the animals are primed for immediate hypersensitivity reactions. Although conclusive evidence is not available, the presence of circulating anti-*H. somnus* antibodies of the IgE class together with previously observed skin test reactivity suggests a role for immediate hypersensitivity in the clinical disease. This would primarily involve the respiratory tract and be expressed as an asthma-like condition.

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