

Immunization of Bulls for the Control of Vibriosis

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The disease we know as vibriosis is caused by the bacterium known as *Campylobacter fetus*. For many years this organism was known as *Vibrio fetus*. The subject matter of this talk on the immunization of bulls for the control of vibriosis is primarily drawn from the work of others as published in the recent veterinary literature.

A vaccination for this disease in females is well established and the use of a vaccine in males first was done in Australia in 1968. Papers were published in the *Australian Veterinarian* on the success of the vaccine in bulls. It was done later in Belgium where bulls were vaccinated to produce both protection from infection and elimination of the organism from infected bulls.

As a basis for discussion of immunization of bulls, I would like to discuss immunization of the female, and the difference between infection of females and males. We ordinarily speak of infection in males but, in the usual sense of the word, there is not an infection. It is, rather, a contamination of the penis and prepuce with the organism. The organism does not penetrate the epithelium and does not produce an inflammation. It is, rather, a commensalism between the organism and the bull. In the female there is inflammation, disease and a local and systemic immune reaction. It is reasonable to expect under these circumstances that the vaccine will work somewhat differently in the two sexes.

The vaccine is administered parenterally and causes a rise in antibody titer in the serum. This can be measured and in some systems the titer will go as high as 1 to 40,000. It is important to remember in dealing with serum antibody against *Campylobacter fetus*, that most cattle have a nonspecific titer that occurs in unexposed animals that may range as high as 1 to 100. The immunization of females results from the action of the disease by producing a systemic immune reaction. When the animal is re-infected or re-immunized, an anamestic response occurs and the titer rises rapidly. The organisms produce disease by a tissue reaction in the uterus and are readily eliminated by the immune response. In the bull the systemic antibody titer must be raised high enough so

that antibody diffuses through the penile and preputial mucosa (as we call the surface of the penis and prepuce), in sufficient quantities to destroy the organism.

We know that usually *Campylobacter fetus* does not become established in the prepuce and on the penis until approximately four years of age. Cornell workers have shown that, at this age, crypts develop in the mucosa of the penis and prepuce and that the organisms become established in these crypts.

Let me return to immunization of the female and describe an experiment that was reported several years ago in the *Journal of the American Veterinary Medical Assn.* Two groups of 99 heifers each were assigned to control and immunized with a commercial vibriosis vaccine. After appropriate interval following immunization, infected bulls were turned in with these heifers. The experiment was evaluated by doing pregnancy examinations after an approximately three-month breeding period and observing the immune response with the mucus agglutination test. In the control group that was not immunized, infection resulted in a geometric mean titer of the vaginal mucus of 1 to 194. Only 11% of those animals that became infected in the control group conceived. Among the vaccinated heifers, seven had mucus agglutination titers that changed from negative to positive during the course of the experiment. The geometric mean titer in these animals was 1 to 72, a lower level than in the control group. Six out of these seven animals did conceive (86%).

Both vaccinated and nonvaccinated animals were infected. In the case of the vaccinated animals, there was a rapid rise in systemic antibody as soon as the infection occurred. This anamestic response quickly eliminated the infection from the uterus. It did so before there was a significant leukocytic or inflammatory reaction and before there was a substantial rise in local antibody. All of this took place before there was time for the organism to damage the uterus and prevent conception.

In the bull, we have already mentioned that the organism exists in the prepuce and on the penis in a state of commensalism. There is no inflammatory response and the organism is not found elsewhere in

the bull, except perhaps in the very distal portion of the urethra. Elimination of the organism in this case requires a sufficiently high level of antibody to diffuse through the mucosa and destroy the organism. The amount of antibody produced by immunization against vibriosis depends upon the amount of antigen and the duration of exposure. The Australian workers have shown that bulls can consistently be cured or protected from infection by administration of a vaccine in an adjuvant that contains 40 mg by dry weight of antigenic material. This is administered subcutaneously and repeated after approximately 30 days.

It is unfortunate that I cannot give you specific information on a commercial vaccine in the United States that is satisfactory for immunization of bulls. None of the commercial vaccines indicate the amount of antigen, nor have they been tested on bulls. To my knowledge, Australia is the only country presently producing a vaccine developed for and tested for use

on bulls. I know that some veterinarians are aware of the value of vaccine in bulls and have been using larger doses of United States commercial vaccine in an attempt to immunize bulls. Their clinical impression is that they have been successful. I am sure that only a very low level of antibody must reach the preputial and penile mucosa. It is essentially an *in vitro* situation when dealing with an organism that is in a commensal relationship with the host.

The question has been raised whether immunized bulls may serve as mechanical carriers. This question has been experimentally examined and the answer is that transmission from infected cows to susceptible cows by an immunized bull is almost nil. I do not think the possible occasional occurrence is of any practical significance.

I do believe that immunization of bulls is a practical procedure for controlling vibriosis and can be used in place of immunization of females.