

Cow-Calf Section

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Adult Vaccination for Brucellosis — Why? Why Not?

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The title of this presentation suggests a parody of the "good news, bad news" stories. Since we are dealing with a serious subject, no comedy is intended and the author will attempt to discuss some of the advantages and disadvantages of adult vaccination against brucellosis.

It was obvious during the preparation of this paper that it was not possible to compile a complete list of references or to give proper credit to the researchers who have published their findings. I am prepared to furnish sources of the information on any phases of my remarks.

Since the title does not limit the discussion to any particular vaccine, it may be useful to briefly mention some of the immunogenic products which have been studied and the methods of their application.

We can divide the agents into two groups—live and inactivated. Some of the live products which have been or are currently being studied are Strain 19, mucoid phases, Rev. 1, 89/23, H-12, 56, 4004/1, 104-M, B-3, B-8, 45, 45 (6), and 45/20. Some of the inactivated agents are P.B., 53H38, 45/20 and field strains. Many of these have been used with adjuvants. Various fractions of brucellae prepared in a variety of ways have also been studied. Methods of administration have included subcutaneous, intramuscular, respiratory, intracaudal, intradermal and intraconjunctival.

It is obvious that large numbers of research studies have been conducted to develop superior immunizing agents.

Since there is only one vaccine approved for usage in the United States, we should limit the scope of the remainder of this paper to Strain 19.

Adult vaccination with Strain 19 was abandoned in the early '50s because of the long recognized diagnostic problems created by its administration. This withdrawal coincided with the accelerating brucellosis eradication program which has continued to this day.

The difficulties associated with the test and slaughter approach to brucellosis eradication resulted in requests from some herd owners to reinstitute adult vaccination in selected situations. Approximately one year ago the brucellosis committee of the United States Animal Health Association met and approved experimental studies using Strain 19 in a limited number of herds in Florida. These studies are underway and several serologic procedures and methods of vaccine administration are being evaluated. References to these will be made during discussions on the benefits and problems from Strain 19.

General Considerations

In spite of the brucellosis eradication program, the disease remains a major problem in many areas of the country. No herd or area is without risk as long as the disease exists in other areas.

There has been an increase in the incidence of cattle brucellosis in recent years and a parallel increase in human cases. Possible explanations for these are many but the decrease in vaccination levels must be one of them.

Two major approaches to elimination of brucellosis have been attempted, often in combination; test and slaughter and calfhood vaccination. In recent years, more emphasis has been placed on test and slaughter and there has been deemphasis of calf vaccination through publicity and reallocation of public funds. Economics may dictate a temporary abandonment of the test and slaughter approach in some herds until herd immunity can be developed.

It is important to remind ourselves of the evolution which has occurred in the cattle industry in recent years; i.e., larger herds and increased cattle movements. These are serious hurdles in disease control and brucellosis, like other diseases, is directly influenced by herd size along with other factors such as levels of herd resistance through vaccinations. The average size of Florida dairy herds is over 300.

There is general agreement that vaccination will decrease the incidence of brucellosis, especially in infected problem herds. It is also generally agreed that Strain 19 will completely protect 65-70% of the exposed cattle under field conditions and provide partial immunity in the remainder. Vaccination will usually reduce clinical disease and the numbers of organisms excreted from infected cattle. One author suggested that the animal infection rate is reduced by 80% and the herd infection rate by 20%. Vaccination alone will not often eradicate the disease.

The resistance engendered by Strain 19 varies among individuals and depends largely upon the virulence and numbers of infective strains. One study showed that it takes an average of 100X more organisms to infect the vaccinee than nonvaccinated cattle. Infected cows which abort or calve normally but which are serologically negative are major problems, especially in large herds. One study reported up to 20% of infected cattle did not have positive titers until after parturition. We determined that 15% of the card test reactors in a large Florida dairy herd were negative at the time of normal or abnormal parturition within the previous two weeks. Vaccination will not prevent this problem but will surely lessen its impact.

Strain 19 is stable and of low pathogenicity. There has never been any evidence of its reversion to a virulent form and it rarely becomes permanently established. It is of relatively high immunogenicity and of moderate agglutinogenicity. It must be given as a live product and there are minimum numbers of organisms necessary to establish immunity. This quantity is unknown at present.

There is no way to measure the immunity produced by Strain 19 or other brucella vaccines except by challenge. The immunity is cell mediated and circulating antibodies are merely a reflection of present or past antigenic experiences.

There is no evidence that adult vaccinees develop a better immunity than calves which have attained immunological competency. This apparently occurs (for Strain 19 antigens) sometime between the first and second months of life. There appears to be no decrease in resistance with age. There is no evidence that immunity is enhanced by revaccination and no evidence that vaccines alter the course of the disease once infection has occurred. There is no evidence of transmission of Strain 19 from a vaccinated animal to a nonvaccinate or production of titers in the latter.

Bulls should not be vaccinated as there are several reported cases of orchitis due to Strain 19. Titers appear to persist longer in bulls and the bull plays a minor, if any, role in natural transmission of the disease.

Diagnostic Problems

This is always given as the major reason for not using Strain 19 in cattle of any age. Cattle vaccinated as adults remain positive on standard agglutination tests for relatively long intervals and a certain percen-

tage fail to return to negative. The decline of titers appears to be more a function of age at the time of vaccine administration than any other factor such as dosage or previous vaccinal status.

Agglutination tests have traditionally been used for the diagnosis of brucellosis because they can be performed on large numbers of samples and can easily be standardized. The standard agglutination tests are inadequate for differentiating titers produced by vaccines and those caused by natural infections.

There are probably more diagnostic methods available for brucellosis than any other animal disease. In recent years many of these have been directed toward identification of quality of antibodies rather than quantity.

After inoculation of Strain 19 or after infection with field strains, the early antibodies produced are IgM. A few days later the IgG type become predominant. However, after Strain 19 vaccination the IgG antibodies disappear rather quickly while in infected cattle they persist. The different patterns of antibody production in vaccination and infection make available a number of methods of distinguishing the titers. Such supplemental tests as mercaptoethanol, rivanol, complement fixation and individual ring tests are useful. Culture methods are also available and are the only ways of distinguishing the rare cows which become permanently infected with Strain 19.

Most workers have found the complement fixation test to be superior to other serologic methods in the diagnosis of brucellosis. However, more simple methods may be more practical under some conditions. The card test is of partial usefulness in differentiation of titers.

We have observed significant differences in results of five serologic tests conducted three months after Strain 19 vaccination in hundreds of adult cattle. No conclusions can be made at this time on the relationship of these findings to bacteriologic studies.

The method of inoculating Strain 19 may possibly prove useful in reducing titer problems. We are studying intradermal inoculations and reduced dosages. We have already observed large differences in the retention of post-vaccinal titers detected by various procedures. No conclusions can yet be made on the resistance produced by alternate methods in our studies.

Post Vaccinal Abortions

There have been several studies conducted on the abortifacient effects of Strain 19. Results have varied depending upon the method of inoculation, stage of gestation, dosage and concurrent infections in the herd. There is a general conclusion that abortions after four months of pregnancy have occurred but are rare. We recently vaccinated 1,000 cows which were open and in all stages of pregnancy. The owner reported four abortions following the vaccine administration. Since the herd is infected, some could be from the disease and not Strain 19 induced. Another group of 200 was vaccinated and there was no owner observed abortions.

There has never been any evidence that Strain 19 has interfered with establishment of pregnancy.

Udder Infection and Public Health

Strain 19 rarely becomes established in the udder and subsequently shed in the milk regardless of stage of lactation or age at time of vaccine inoculation. There is production of milk antibodies if the cow is lactating which ceases in a few weeks. Apparently most of these antibodies originate from humoral circulation and are not locally produced in the udder.

There is no proof that man has ever become infected through ingestion of Strain 19-contaminated milk. Pasteurization destroys Strain 19 and it is unlikely that those few humans with hypersensitivity would be affected due to dilution.

Reduced Milk Yield - Feed Consumption - Fever

Several studies have indicated that there may be up to a 20% loss in milk production for a few days if lactating cows are vaccinated with Strain 19. Other workers have reported no losses occurred.

We observed an 11% drop in milk yield and a 15% reduction in feed consumption beginning two days after Strain 19 vaccination in 750 cows. Both returned to normal in 7-10 days.

There have been a few reports of a temporary fever following Strain 19 inoculation in adult cattle.

Conclusions

Vaccination of sexually mature cattle with Strain 19 should only be used in herds where brucellosis is active as a means of rapidly developing herd immunity. The ultimate goal must be the elimination of the disease through all available methods.

The most serious disadvantage of adult vaccination is the interpretation of serologic tests. These

problems are largely related to the type of test employed. The use of a battery of supplemental tests and proper application of the results will greatly assist in a correct diagnosis.

Alternate methods and dosages of administration of Strain 19 are being evaluated. These studies may assist in solving some of the diagnostic and other problems associated with past procedures.

Strain 19 is not an ideal vaccine but is the only approved immunogenic product for the control of brucellosis in the United States. It has been used on millions of cattle and until a better vaccine is developed the livestock and dairy industries will continue to depend upon it. Calfhood vaccination must be strongly encouraged.

I do not know the future role of adult vaccination will assume, if any, in the control of bovine brucellosis. I do know there is no way to ignore veterinary expertise in any animal disease control program and we must constantly apply all of our available knowledge in our efforts.

Questions

1. Strain 19 is often localized in the udder of vaccinated cows and shed in the milk for extended periods. True or False
2. There is little public health hazard in excretions of Strain 19 from vaccinated cows. True or False
3. Strain 19 frequently causes abortion in cows vaccinated in late stages of pregnancy. True or False
4. Research studies in recent years have indicated that the quality of antibodies in the diagnosis of brucellosis is more important than the quantity. True or False
5. There may be decreased milk production, fever, and decreased feed consumption following adult vaccination in cattle with Strain 19. True or False
6. The agglutinin response following Strain 19 can be used as a measure of the immunogenic effectiveness of the vaccine. True or False

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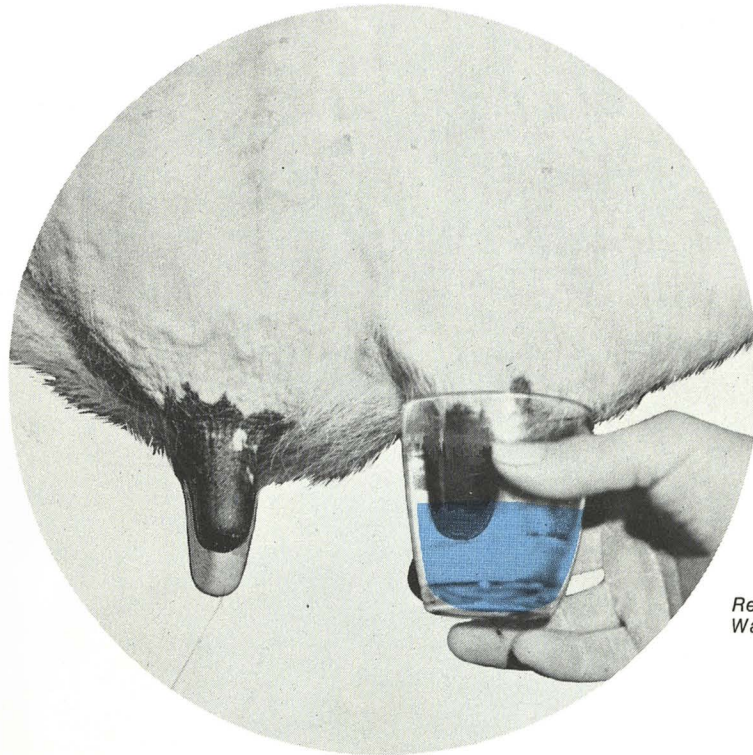
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