

# Control of Salmonellosis in Calves: A Clinical Evaluation of Dry Cow Vaccination

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Calfhood salmonellosis continues to be a major source of economic loss for dairies and commercial calf growers in Southern California. Almost all dairies in our area are drylot operations ranging in size from 200 to 1,200 milking cows. Replacement heifers are raised on the premises or by a commercial calf grower in our area until they are four to eight months old, at which time they are usually shipped out of Southern California. The two most significant health problems our calf growers experience are: (1) neonatal calf diarrhea ("colibacillosis," calf septicemia, reo-, and/or corona virus), and (2) salmonellosis. Salmonellosis may be slightly less prevalent than "colibacillosis," but may represent an equal or greater economic loss since it affects older calves, is resistant to therapy, and is extremely difficult to control.

*Salmonella typhimurium* (and occasionally *S. dublin*) have been routinely cultured from post-mortem tissues of calves exhibiting typical clinical signs. Isolations have been made from many organs, but are most commonly made from liver, mesenteric lymph node, lung, and mediastinal lymph nodes. Salmonellosis usually affects calves aged two weeks to four months, with most cases occurring about five to ten weeks of age. There is an acute and a more chronic form of the disease. In the acute case, an apparently healthy, usually younger calf (two to six weeks of age) experiences a sudden onset of fever (T 104-106°F), depression, and possibly diarrhea. The calf is unresponsive to antibacterial, fluid, and electrolyte replacement therapy and usually dies in 8 to 48 hours. Post-mortem examination reveals few visible lesions except petechiation of intestinal mucosal and serosal surfaces, and dehydration. In the more common chronic form the disease persists and is characterized by depression, persistent fever, severe weight loss and muscular wasting, a weak, weaving gait, a less vigorous but persistent appetite (even in later stages of the disease), and diarrhea (may occasionally be blood-tinged) that may or may not be present. Frequently, pneumonia may develop. The chronic form of the disease lasts from several days to three weeks. Morbidity on infected premises has ranged from 5 to 50%. The mortality in affected calves is frequently severe, but can vary from less than 10% to greater than 90%. Post-mortem examination of these calves reveals severe emaciation, hepatic enlargement, icterus, enlarged mesenteric lymph nodes and slight reddening of the abomasal and in-

testinal mucosal surfaces. When there is pulmonary involvement it is additionally characterized by a severe sero-fibrinous pneumonia and pleuritis.

Treatment of affected calves may be helpful, but response is not dramatic. Fluid and electrolyte replacement therapy are combined with an antibiotic (chloramphenicol, ampicillin, and furaltadone are most commonly used). Improved colostrum management, calf grouping procedures, disease detection, and overall sanitation and management practices can greatly affect the incidence and severity of salmonellosis on a given premises. A dry cow vaccination program is frequently initiated simultaneously to a review of the total management program. The development of better management and improved sanitation, and the adoption of a salmonella vaccination program frequently leads to adequate or excellent control of calfhood salmonellosis on a previously affected dairy. To determine the efficacy of a vaccination program, apart from the other preventive measures, is most difficult in an uncontrolled field situation.

The only vaccine available in the United States for use in a salmonellosis control program is an inactivated product containing *S. typhimurium* and *S. dublin* antigens (Paratyphol-Cutter Laboratories). No efficacy testing has been done on this product. The intent of our vaccination procedure is to immunize the dam and produce maximal antibody titers just prior to the formation of colostrum and the occurrence of colostrum antibody enrichment. If the colostrum can be enriched with vaccine-induced antibodies, then through the feeding of this enriched colostrum passive immunity may be conferred upon the calf. To accomplish this, two doses of vaccine are administered, one at drying off and the second at 7-1/2 to 8 months of gestation.

Although no efficacy testing has been done on the vaccine, we have chosen to use it on an "empirical" basis for the following reasons:

1. An experimental live vaccine has been shown to produce passive protection in challenged calves.
2. An inactivated vaccine has been developed that produced increased titers in the dry cow, in her colostrum, and in calves that received the colostrum.
3. Although the presence of humeral antibody is not necessarily indicative of protection (due to survival of the salmonella organism within the macrophage), it has not been conclusively proven to be ineffective.

4. The cost of the program in labor and drugs represents a negligible investment that could afford considerable benefits.

5. The continued participation by an owner or herdsman in a vaccination program keeps the disease problem foremost in his mind and helps to optimize efforts at disease control.

There are many dairies in our area that have been using this vaccine for up to five years. In an attempt to evaluate the vaccination program, 23 dairies with a history of calfhood salmonellosis and the adoption of control measures, including a dry cow vaccination program, were surveyed. The sample bias includes a number of unidentified factors, but generally includes the more intensively managed dairies where post-mortem examination and cultural procedures are more likely to occur. Selection for the survey was further limited to those premises where calf mortality figures could be established with reasonable accuracy. The size of the calf-raising units ranged from 60 to 500 calves started per year, with an average of 250. Colostrum management was rated as good or excellent on these dairies. No commercial calf ranches were included in the survey.

Over half of the dairies surveyed were initially reporting severe losses to salmonellosis, six dairies were reporting moderate mortality, and three reported their losses as mild. All of them adopted and adhered closely to the recommended dry cow vaccination program. Approximately 1/4 of them included their springing heifers in the vaccination program. Nearly 40% (9 of 23) of the owners reported excellent results (little or no mortality due to salmonellosis) that they attributed to the dry cow vaccination program. An additional 1/3 (8 of 20) rated their results as good (marked decrease in mortality). Three of 20 (15%) reported the response as fair or poor (little or no decrease in mortality). Three owners (15%) had too many management changes to realistically evaluate the program. Current mortality rates on these dairies average 10.5% with nearly 2/3 reporting less than 10% mortality and only three dairies showing greater than 15% mortality. Nine dairymen report most mortality under ten days of age (an indication that salmonellosis may not be a major factor) while another eleven claim at least 50% of their death loss is after ten days of age.

The vaccination of springing heifers frequently entails extra labor and was not usually done. It was recommended where a salmonellosis problem persisted after adoption of vaccination and other control procedures. Three of five dairymen reported good or excellent results following the inclusion of springing heifers in the vaccination program.

This survey would be more useful if accurate mortality figures were available prior to the adoption of control procedures. Since they are not, the only indication of reduction in mortality is the owner's subjective evaluation of their results and their current mortality figures. In our practice area, a mortality figure of 10% across 23 dairies and nearly 6,000 calves

per year is at least average.

**It is not my intent, nor does this report establish the efficacy of a dry cow vaccination program for the control of calfhood salmonellosis. What I hope I have established is:**

**1. Calfhood salmonellosis is a serious economic loss to the intensive dairy operations in our area.**

**2. Disease treatment has had poor results.**

**3. Preventive programs that involve sanitation, management, and vaccination often achieve good control.**

**4. Empirical evaluation of the vaccination program by dairymen and veterinarians is supportive.**

**5. Further field testing under controlled conditions is sorely needed if we are to attempt to clearly evaluate the factors that will assist us in salmonellosis control.**

#### Discussion

Question: Who makes this one vaccine that you say is available?

Answer: It is distributed by Cutter and manufactured by Bayvet in Shawnee, Kansas.

Question: In your culturing work, did you take any of the specific cultures and have a bacterin made and use it in this specific herd where you did this culture, or did you rely on the commercial vaccines altogether?

Answer: No, we did not make any autogenous bacterins. We used commercial vaccines only.

Question: Have you had any problems with adverse reactions in the cows after vaccination? (In the dry cows?) Yes.

Answer: No.

Question: Is the culturing for salmonella fairly easy? Should a regular human hospital laboratory be able to do this without too much problem, or would you send it out to a state veterinary laboratory? I see a lot of things that look to me like they ought to be salmonella but we never culture it out of there.

Answer: We started out sending ours to the regional laboratory and found out after we had a little conference with our laboratory and simply by use of brilliant green agar, some McConkeys agar, and three sugars, that we feel real confident in diagnosing it and have very high recovery rates.

Question: Is this even with one of these calves that is very dehydrated, that lingers on for months? He still ought to be shedding this to a degree where you can culture it fairly easy?

Answer: We do most of our culturing on post-mortem tissues. We have not done very extensive fecal culturing.

Question: Do you have any thoughts on fecal culturing in the live animal, as far as how accurate it would be?

Answer: One of my associates went in to try to identify carriers on a calf ranch and expected to find very, very many because of the problem we had. In that one procedure, I'm not sure, maybe Dr. Blackmore is here and could comment, we recovered far fewer carriers than we expected. I don't know whether that was the result of poor cultural technique or the fact that we did not have any carriers.

Question: Yes, this is what I'm wondering. Whether these live calves were just not picking them up.

Answer: I really couldn't comment on that.

Question: A little clarification. There is some unpublished data which we have done in our laboratory (*tape indistinct*) . . . 75% protection against clinical signs. All of the producers of salmonella typhimurium bacterin do run a mouse protection test on every serial bacterin produced. This mouse test has been correlated with this host animal efficacy test. This test is in the process right now of being put in the federal code of regulations where every serial will be tested by them and by veterinary services laboratory. Another thing that has been found in this mouse test is that there is cross protection between the serial types within the general antigenic classifications, between typhimurium and those other ones

in that class. Just for comment.

Answer: I have a question for you, then. You're saying that there is cross protection with your bacterin?

Question: Yes, to the extent that we have evaluated it. Of course, we haven't included all serial types but we're seeing a great deal of cross protection within the general antigenic types.

Question: I have a question about vaccinating the calves themselves. I'll give you a brief history. We have a salmonella problem in a herd that's doubled. We are on a dry cow vaccination program. This works great up through about eight weeks, then we start losing calves. I just assume that the passive immunity that

they have interferes with the use of the bacterin. Would you care to comment? Have you attempted to use bacterin on calves that have had colostrum from vaccinated cows?

Answer: Your question is have we used bacterins on calves in addition to the colostrum?

Question: Well, used bacterin on calves from vaccinated cows.

Answer: Yes, I think we have. Mainly where we have gone to bacterins in calves is with the commercial calf ranch that does not have control over the source of colostrum. We have attempted to use it in a number of ways in very young calves, from day old to a few weeks old, in multiple doses and I would say with poor results.

Question: Thank you. That agrees with my thought, too.

