The Effect of Feeding Low Levels of Chlortetracycline for Extended Periods on the Carrier State of Anaplasmosis

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The elimination of the carrier state of anaplasmosis by feeding high levels of chlortetracyclines is an accepted control measure in anaplasmosis. Chlortetracyclines in doses ranging from 1.5 to 5 mg per pound of body weight each day (mg/lb) for sixty (60) to thirty (30) days, respectively, has been reported to eliminate the carrier state of anaplasmosis (2,4,5,12). Based upon reduction of CF titers, feeding low levels of chlortetracycline for extended periods (0.5 mg/lb for 120 days) has been reported to reduce the infectivity of the treated herd (3,4).

Several workers report that cattle from which anaplasmosis has been eliminated have exhibited resistance to subsequent experimental challenge (6,11).

This experiment was conducted to determine the effect of a low oral dose of chlortetracycline for an extended period (0.5 mg/lb for 120 days) upon the carrier state of bovine anaplasmosis and to determine the degree of resistance to clinical anaplasmosis in the animals from which *Anaplasma marginale* was previously eliminated.

Laboratory Procedures:

Hematologic and serologic procedures were conducted as previously reported (9,10).

Experimental Procedure:

The experiment was conducted in two phases which are described as follows.

First Phase. Fifteen anaplasmosis carrier steers and heifers, of approximately two (2) years of age were randomly assigned to two (2) treatment groups. Groups IA and IB consisting of ten (10) and five (5) carrier animals, respectively. Each group was maintained under controlled dry lot conditions for the feeding period of this experiment.

Medicated Group IA was fed 0.5 mg chlortetracycline per pound body weight each day for one hundred twenty (120) days. The medicated ration was prepared by mixing chlortetracycline with a commercial feed at the rate of ten (10) pounds of Aureomycin® Ten D per ton of feed and was fed at the rate of one pound for 100 lbs. of body weight each day. Each animal was individually fed to assure adequate consumption.

Nonmedicated Group IB, consisting of five (5) *A. Marginale* carriers, was fed the same concentrate ration without the chlortetracycline for one hundred twenty (120) days. Throughout the experiment, CF titer and body weights were determined at two-week intervals. Feed adjustments were made when necessary.

To determine whether the carrier state had been eliminated, subinoculation tests were conducted at twenty-eight (28) and one hundred eighty (180) days after medication ceased. The first subinoculation (28 days post feeding) consisted of collecting 500 ml of whole blood from each animal of medicated and nonmedicated Groups IA and IB and injecting intravenously into respective susceptible recipients. The second subinoculation (180 days post medication) consisted of the intravenous injection of 500 ml of whole blood from each animal of the medicated Group IA and of 10 ml from each animal of the nonmedicated Group IB into respective susceptible recipients. The reduced volume of inoculum in the second subinoculation was to prevent an overwhelming infection noted in the first subinoculates from nonmedicated Group IB.

Second Phase. To determine the degree of resistance in an animal from which the carrier state of anaplasmosis had been eliminated, the ten (10) animals of medicated Group IA and an additional five (5) *A. marginale* negative control animals (Group II) were challenged, 180 days post medication, with 5 ml of anaplasmosis-carrier blood. Daily PCV, % infected RBC, and CF titers were determined to compare the disease response of the two groups.

Results of First Phase:

The mean CF titer (logarithm$_{10}$ of the reciprocal of the highest or suspicious CF titers) for medicated Group IA and nonmedicated Group IB is illustrated on Graph 1. At the start of the experiment (Day 0), at the end of medication (Day 120), and at the end of the first phase (Day 300), the medicated Group IA had mean CF titers of 2.53, 0.17 and 0, respectively. In contrast, the nonmedicated Group IB had mean CF

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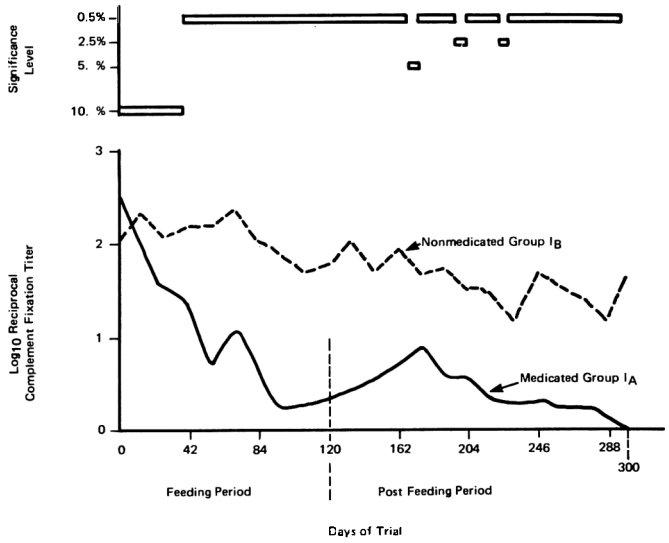
®; Aureomycin is a trade name for chlortetracycline. The American Cyanamid Co., Princeton, N.J.



Graph 1: Comparison of complement-fixing titers of medicated and nonmedicated carriers.

titers of 2.8, 1.8 and 1.66.

In both subinoculation tests (28 and 180 days post medication) recipients of whole blood from animals of medicated Group IA remained uninfected and the recipients from animals of nonmedicated Group IB became infected with anaplasmosis.

Results of Second Phase:

All fifteen challenged animals (Groups IA and II) became infected with anaplasmosis.

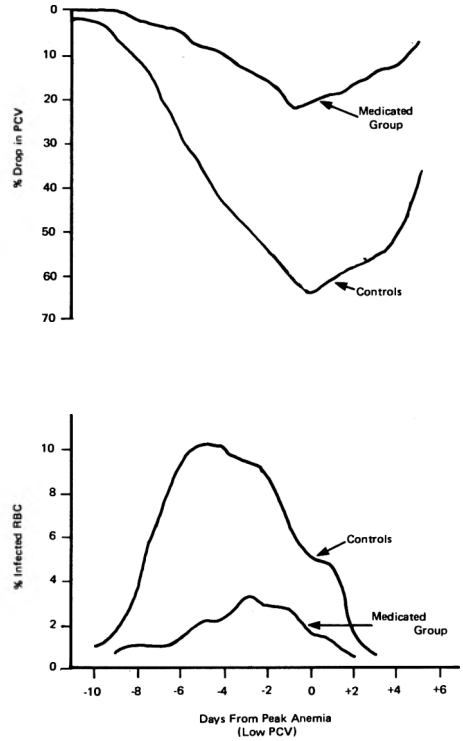
The disease responses in the challenged medicated Group IA animals included the development of a persistent positive CF titer to *A. marginale* ranging from 2.51 to 3.41 ($\bar{x}$ = 2.96, SD = 0.25), a maximum % infected RBC ranging from less than 1% to a high of 11% ($\bar{x}$ = 2.6, SD = 3.42), a minimum PCV ranging from 14.5% to 41.5% ($\bar{x}$ = 32.60, SD = 8.96), and a maximum percent drop in PCV ranging from -4.5% to -54%($\bar{x}$ = 22, SD = 16.5). Whereas in Group II (controls) the clinical response to the infective challenge induced a persistent positive CF titer in all animals ranging from 3.41 to 3.71 ($\bar{x}$ = 3.56, SD = 0.17), a maximum % infected RBC ranging from 8 to 15% ($\bar{x}$ = 13, SD = 3.37), a minimum PCV ranging from 8.9 to 16.5% ($\bar{x}$ = 13.35, SD = 3.42), and a maximum percent drop in PCV ranging from -57 to -74% ($\bar{x}$ = 64.5, SD = 7.27). One control animal died of an atypical case of anaplasmosis and upon necropsy was found to possess an atrophied spleen. The information collected on this animal was not included in the data.

Discussion and Conclusions:

At the start of the feeding period (Day 0), the CF titer comparisons between medicated Group IA and nonmedicated Group IB were not significantly different. As the feeding continued, a significant difference ($p < .005$) developed at forty-two (42) days on feed and persisted throughout the remainder of the feeding and post-feeding periods, Graph 1. Within medicated Group IA the CF titers at Day 0 of the trial and Day 120 (end of feeding) and between Day 0 and Day 300 (180 days post feeding) are significantly different ($p < .005$). Within the nonmedicated Group IB the CF titers did not significantly change.

Subinoculations from Groups IA and IB (medicated and nonmedicated) at twenty-eight (28) and one hundred eighty (180) days after medication revealed that anaplasmosis was eliminated from the medicated animals (0.5 mg chlortetracycline per pound body weight each day for 120 days) and that untreated animals remained carriers.

Challenging the ten (10) animals from which the carrier state was eliminated (Group IA) and five (5) negative control animals (Group II) with an infective dose of *A. marginale*-carrier blood provided a direct comparison of the disease response between the two groups. The disease response to the challenge was quite different between the two groups. The reinfected medicated (Group IA) animals responded similar to *A. marginale*-challenged animals following vaccination with a killed antigen vaccine (1,7,8). The disease response was not as severe as that seen in challenged control animals. The degree of anemia, as shown by the PCV and % drop in PCV, was substantially less than the degree of anemia exhibited by the challenged negative controls as shown on Graph 2. The maximum % infected RBC'S was also found to be different between the two groups, with the medicated Group IA exhibiting considerably lower % infected RBC's than the control Group II (Graph 2). Other workers have previously substantiated the



Graph 2: Mean response comparisons between Group IA (medicated) and Group II (controls) to a challenge with *A. marginale*.

presence of this resistance found in animals from which the carrier state of anaplasmosis has been eliminated (6,11). The duration of this resistance has not been determined.

Summary:

Anaplasmosis carrier infection was eliminated by feeding chlortetracycline in a ration at the dosage of 0.5 mg per pound body weight daily for 120 days. The CF test for anaplasmosis gave a negative reaction on all treated animals 180 days after treatment ended. The medicated animals did not transmit anaplasmosis on subinoculations into susceptible animals at 28 days and 180 days post treatment. The cattle from which anaplasmosis was eliminated were highly resistant to characteristic acute anaplasmosis infections after being reinfected with *A. marginale.*

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