

Immune, health, and growth responses of beef calves administered modified-live virus respiratory vaccine in the presence of maternal antibody versus a traditional vaccination regimen

J. G. Powell, DVM, PhD¹; J. T. Richeson, PhD²; E. B. Kegley, PhD¹; K. P. Coffey, PhD¹; G. F. Erf, PhD¹; D. T. Ensley, DVM, MS³

¹Division of Agriculture, University of Arkansas, Fayetteville, AR, 72701

²Department of Agricultural Sciences, West Texas A&M University, Canyon, TX, 79016

³Boehringer Ingelheim Vetmedica, Inc., St. Joseph, MO, 64506

Introduction

Typical preconditioning guidelines recommend that calves be vaccinated against respiratory and other pathogens at or near weaning (~205 days) because of the historical belief that maternal antibodies from colostrum ingested by the neonatal calf may interfere with the immune response to vaccination. However, recent research investigating vaccination during the presence of maternal antibodies suggests that neonatal calves vaccinated with a modified-live virus (MLV) vaccine are protected from subsequent BVDV challenge and immature calves vaccinated at 67 days of age develop both an initial and anamnestic antibody response. Our objective was to determine the effects of administration of a pentavalent MLV respiratory vaccine to calves at approximately 60 days of age versus at a traditional vaccination regimen age (near weaning) on health, growth performance, and BVDV type 1a-specific antibody titers and T cell activation.

Materials and Methods

Crossbred beef calves (n=253) from three breeding herds were used to compare two different pentavalent MLV vaccine regimens. Calves were stratified by date of birth, sex, body weight, and dam parity and then randomly assigned to one of two vaccine regimens. The early vaccination (EV) treatment group was administered a pentavalent MLV respiratory vaccine containing *M. haemolytica* leukotoxin (Pyramid® 5 + Presponse® SQ, Boehringer Ingelheim Vetmedica, Inc.) on day 0 (mean \pm SD calf age, 62 \pm 17 days). The traditional vaccination (TV) treatment group received the same pentavalent MLV respiratory vaccine on day 126 (mean \pm SD calf age, 188 \pm 17 days). Both treatment groups were revaccinated with the pentavalent MLV respiratory vaccine at weaning on day 147. A subset of calves was randomly selected for collection of blood samples for humoral and cell-mediated immune assays. To determine humoral immune response, blood samples were collected on days 0, 21, 126, 147 (weaning), 175, and 231; serum was separated, decanted, and stored frozen until subsequent analysis by serum neutralization for determination of BVDV type 1a

(Singer strain) antibody titers. Blood samples were collected into tubes with an anticoagulant on days 0, 7, 21, 42, 126, and 189; peripheral blood mononuclear cells were harvested and a multi-parameter flow cytometry assay was used to conduct cell population analysis indicative of CD25 expression index.

Results

No calves required treatment for BRD during the study, which ended after an 84-day post-weaning period. Interim and overall gain performance was similar ($P \geq 0.84$) between vaccine treatments throughout the study. On day 0, serum BVDV type 1a antibody titers were present, presumably from maternal transfer, but the antibody titers did not differ ($P = 0.50$) between vaccine treatments. However, on days 21, 126, and 147, the EV group had significantly higher BVDV antibody titers, compared with those of the TV group. There was a treatment-by-day interaction ($P = 0.05$) for the CD25 expression index of CD8+ cells; EV calves had a greater expression index than did TV calves on day 126. Differences in the BVDV type 1a antibody titer concentrations and CD25 expression indices observed in this study suggest that calves develop both humoral and cell-mediated immunity when vaccinated at 62 days of age. Furthermore, neither growth performance nor health were affected by vaccine regimen.

Significance

Differences in serum BVDV type 1a antibody concentrations indicate that calves (approx 62 days of age) vaccinated at branding develop a humoral immune response despite maternal antibodies being present. For calves in the EV group, BVDV type 1a antibody titers were higher during the pre-weaning phase and were similar during backgrounding phase, compared with those of calves in the TV group that were vaccinated with a traditional preconditioning regimen. Administration of MLV respiratory vaccine to calves that still had circulating maternal antibodies stimulated a cell-mediated immune response. These results support early vaccination as safe and effective alternative to traditional at-weaning vaccination regimens.