Assessing the Epidemiologic Impact of Vaccination for Bovine Viral Diarrhea Virus

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Introduction

Currently, to validate efficacy of BVDV vaccines, clinical trials commonly involve challenge of vaccinates with a single intranasal inoculation of a BVDV field strain. Licensed vaccines provide nearly complete protection (91 to 100%) of dams and developing fetuses after this artificial challenge. However, exposure to animals persistently infected (PI) with BVDV may better represent viral challenge under field conditions. The objective of this research is to assess the efficacy of vaccination for control of bovine viral diarrhea virus (BVDV).

Materials and Methods

Eighty heifers were randomly assigned to one of four treatment groups. Group C (n = 11) served as non-vaccinated controls, while three groups were vaccinated with BVDV at weaning (d0), four weeks post-weaning (d28), one-year of age (d168) and four weeks later (d196). Heifers were weighed and blood samples collected for BVDV isolation and neutralization at the time of each vaccination. The vaccines were selected after consulting a large distributor of animal health products in the southeastern United States. Based on volume of sales, Bovishield Gold® FP5 (Pfizer Animal Health; Group B, n = 23), Pyramid® 5 (Fort Dodge Animal Health; Group P, n = 23) and Virashield® 6 (Novartis Animal Health; Group V, n = 23) were administered to the treatment groups. These top selling vaccines represented two modified-live products containing both cytopathic type 1a and type 2 strains of BVDV with label claims for fetal protection (Groups B and P) and an inactivated product containing a cytopathic type 1a strain of BVDV, a noncytopathic type 1 strain of BVDV and a noncytopathic type 2 strain of BVDV (Group V). Estrus was synchronized to facilitate artificial insemination (AI) of all heifers over a three-day period, after which bulls were introduced. Pregnancy status and gestational age were assessed 61 days post-AI via transrectal ultrasound. Three PI animals (persistently infected with a type 1a, 1b or 2 field strain of BVDV) were commingled with the pregnant heifers in an isolated pasture from days 68 to 126 post-AI (d287-345). The exposed heifers were monitored for clinical disease, loss of pregnancy and viremia. Calves born in September 2008 will be assessed for PI status.

Results

Average daily gain (ADG) between d0 and d28 was significantly different among groups (P = 0.01), at 1.63 lb (.74 kg), Group V; 1.55 lb (0.70 kg), Group C; 1.35 lb (0.61 kg), Group B; and 1.16 lb (0.53 kg), Group P. From d0 to d168, ADG was not significantly different among groups. Seventy heifers became pregnant (n = 20 for Group B, P, and V; n = 10 for Group C). Immediately prior to introduction of the PI animals (d287), Group P had the highest concentration of BVDV-neutralizing antibodies, followed by Groups V and B, respectively. Group C exhibited no BVDV-neutralizing antibodies on d287. On days six to 10 post-exposure (PE; d293-297), viremias were detected only in heifers from Group C (10/10; four type 1a, two type 1b and four type 2) and Group V (9/20; three type 1a, two type 1b and four type 2). On day 28 PE (d315), an additional heifer was viremic in Group V (type 1b) and Group P (type 2). On day 58 PE (day of PI removal; d345), no heifers were viremic. All exposed heifers maintained their pregnancy, and calves are due in late September 2008.

Significance

Some vaccines exhibit a greater impact on ADG, which is economically important if ownership changes within a few weeks of vaccination. However, compensatory gain eventually neutralizes differences in ADG indicating that this effect is less critical if ownership is retained. Vaccination with modified-live BVDV provided greater protection against viremia than vaccination with inactivated BVDV. The fact that not all vaccinated animals were protected against viremia emphasizes the need to include biosecurity and removal of PI animals as part of a BVDV control program. Also, two heifers became viremic 28 days PE, which indicates the need for prolonged exposure to assess the true efficacy of licensed BVDV vaccines.