

Effects of postpartum calcium treatment on blood calcium concentration

C.D.Blanc, DVM¹; Mark van derList, BVSc, MPVM²; Sharif S. Aly, BVSc, MPVM, PhD³; Heidi Rossow, PhD³; Noelia Silva-del-Rio, DVM, PhD³

¹Pacific Rim Dairy, Corcoran, CA 93212

²Boehringer Ingelheim Vetmedica, Sacramento, CA 95616

³UC Davis, Veterinary Medicine Teaching and Research Center, Tulare, CA 93274

Introduction

To prevent the negative consequences of subclinical hypocalcemia, it is common practice to treat postparturient high-risk dairy cows with supplemental calcium prophylactically either by oral or IV administration; however, the effect of prophylactic calcium administration on blood calcium concentration has not been evaluated. The objective of this study was to evaluate the effects of prophylactic postpartum calcium treatments (IV and oral bolus) on postpartum blood calcium concentration.

Materials and Methods

In February 2013, 33 multiparous (lactation ≥ 3) Jersey-Holstein crossbred cows that were fed a negative dietary cation-anion difference (DCAD) ration prepartum were enrolled in a randomized block design study conducted on a large commercial dairy farm in California. Immediately after calving, the serum calcium concentration for each cow was determined by use of an on-farm blood analyzer (Vetscan 200-1000R, Abaxis), and cows were blocked in accordance with their serum calcium status (normocalcemic, 8–10 mg/dL [$n=15$] or hypocalcemic, < 8 mg/dL [18]). Within each block, cows were randomly assigned to 1 of 3 treatments: 1) no treatment (control; $n=11$); 2) 500 mL of a 23% calcium gluconate solution (Duravet), IV in the right subcutaneous abdominal vein over 15 minutes immediately after calving (CA-IV; 11); or 3) 1 BoviKalc bolus (Boehringer Ingelheim), PO immediately and at 12 hours after calving (CA-Oral; 11). Blood samples were collected via venipuncture of the coccygeal vein immediately (0 hours) and at 1, 2, 4, 8, 12, 16, 20, 24, 36, and 48 hours after treatment. Serum samples were sent to Marshfield Labs (Marshfield, WI) for total calcium analysis. Serum calcium concentration was compared among the treatment groups by use of repeated measures with the MIXED procedure (SAS Inc., Cary, NC). Block and cow were included in the model as random terms. The covariance structure that minimized Akaike's information criterion was used to account for repeated measures on individual cows. Variables with values of $P \leq 0.05$ were considered significant. A significant interaction between treatment and time was identified, and pairwise differences among the 3 treatments were determined by use of the SLICE option in the LSMEANS statement. For each

time point at which there was a significant difference in serum calcium concentration among the 3 treatments, comparisons were made by use of the PDIF option in the LSMEANS statement.

Results

Serum calcium concentration did not differ significantly among the 3 treatments; however, it was significantly associated with time and the interaction between treatment and time. At 1, 2 and 4 hours after treatment, the mean serum calcium concentration was significantly ($P < 0.001$) higher for the CA-IV group (T1, 11.4 mg/dL; T2, 10.2 mg/dL; and T4, 9.4 mg/dL), compared with that for the control (T1, 7.5 mg/dL; T2, 7.5 mg/dL; and T4, 7.6 mg/dL) and CA-ORAL (T1, 8.0 mg/dL; T2, 8.1 mg/dL; and T4, 8.1 mg/dL) groups. Mean serum calcium concentration was significantly ($P < 0.05$) lower for the CA-IV group (T20, 7.9 mg/dL; T24, 7.7 mg/dL; T36, 6.7 mg/dL; and T48, 7.4 mg/dL), compared with that for the CA-ORAL group (T20, 6.8 mg/dL; T24, 6.4 mg/dL; and T36, 8.2 mg/dL) at 20, 24, and 36 hours after treatment and compared with that for the control group (T36, 8.1 mg/dL and T48, 8.9 mg/dL) at 36 and 48 hours. Although not statistically significant, the mean serum calcium concentration for the CA-ORAL group was approximately 0.5 mg/dL higher than that for the control group at 1, 2, 4, 8, 12, 16, 20, and 24 hours after treatment.

Significance

Results indicated that cows in the CA-IV group had an initial increase in serum calcium concentration followed by hypocalcemia at 20 to 48 hours after treatment that was more severe than that measured before treatment. This finding suggests that a cow's ability to maintain calcium homeostasis might be compromised by IV prophylactic calcium administration, and the physiologic implications of the subsequent transient hypocalcemia need to be evaluated. The mean serum calcium concentration for the cows in the CA-ORAL group did not differ significantly from that for cows in the control group, and prophylactic administration of 1 BoviKalc bolus immediately and 12 hours after calving consistently maintained the mean calcium concentration within the established normocalcemic range.