Calcium Chloride and Calcium Sulfate in a Bolus as a Supplement for Hypocalcemia in Dairy Cows

KEY POINTS

- BOVIKALC® Oral Mineral Supplement bolus increased ionized calcium levels after calving.
- Cows given BOVIKALC maintained ionized Ca above 1.0 mmol/L after the initial bolus was administered.
- At 24 hours postpartum, the urine pH of cows given BOVIKALC was 6.79 versus 8.04 for the non-supplemented cows.

INTRODUCTION

Clinical hypocalcemia (milk fever) occurs in 5-10% of dairy cows. However, this is only the tip of the iceberg. The incidence of subclinical hypocalcemia, low blood calcium without evidence of clinical signs, is estimated to range from 23-39%.[1] Maintaining calcium homeostasis in the periparturient cow is important as hypocalcemia, clinical or subclinical, can result in a greater risk of other metabolic conditions and periparturient diseases such as retained placenta, ketosis, mastitis, and displaced abomasum.[2]

Modifying the dietary cation-anion difference (DCAD) of the close-up dry cow diet, limiting calcium intake during the dry period, injecting calcium, or administering an oral calcium supplement immediately after freshening are strategies frequently utilized to prevent hypocalcemia. The BOVIKALC bolus is an oral calcium supplement containing calcium chloride and calcium sulfate. The bolus is labeled for administration prior to, or immediately after, calving followed by a second bolus 12 hours later. The objective of this study was to investigate the effect of the BOVIKALC bolus on calcium homeostasis during the first 24 hours postpartum.

MATERIALS AND METHODS

Twenty, multiparous, Holstein cows were utilized in the study. During the dry period, cows were housed in a sand bedded free stall barn with ad libitum access to clipped pasture, a TMR, and water. The TMR was formulated to meet NRC requirements, contained no anionic salts, and had a DCAD of 19.36 meq/100g.

Blood samples were collected at approximately 48 and 24 hours prior to calving and again at calving for on-site measurement of ionized calcium (iCa) using an IDEXX Vet Stat Analyzer. Cows with iCa <1.10 mmol/L at calving (0 hr.) were blocked by parity and day of calving and randomly assigned to one of two treatment groups: 1) BOVIKALC (B) – received one bolus immediately after calving and a second bolus 12 hours after calving, or 2) Control (C) – received no supplemental calcium.

Two blood samples and a urine sample were collected at 0, 1, 6, 12, 13, and 24 hours postpartum. One blood sample was collected in a sodium heparin vacutainer tube for on-site measurement of iCa and pH. The second blood sample was collected into a serum separator tube. Serum was separated and stored at -20°C. Urine pH was measured on-site using an electronic pH meter and then urine samples were stored at -20°C. At the conclusion of the trial, atomic absorption spectrometry was completed on serum and urine samples to determine total calcium and urinary calcium.

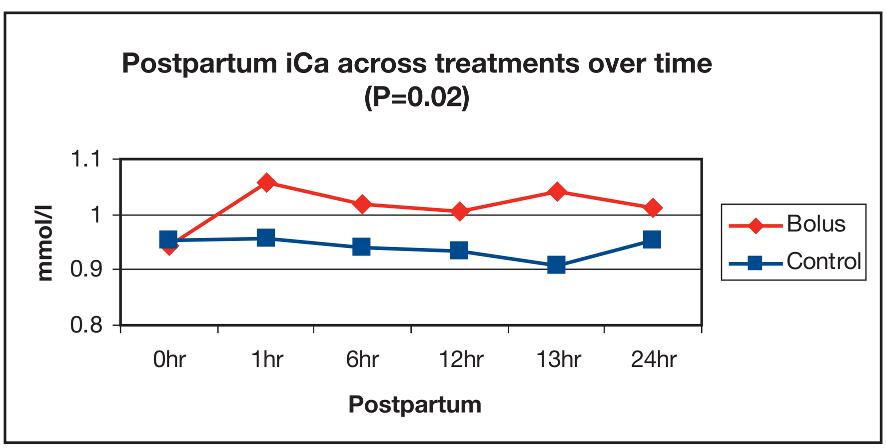
Rectal temperatures and clinical scores for appetite, ataxia, fecal consistency and muscle tremors were recorded at 0, 6, 12, and 24 hours postpartum.

RESULTS

Blood Calcium

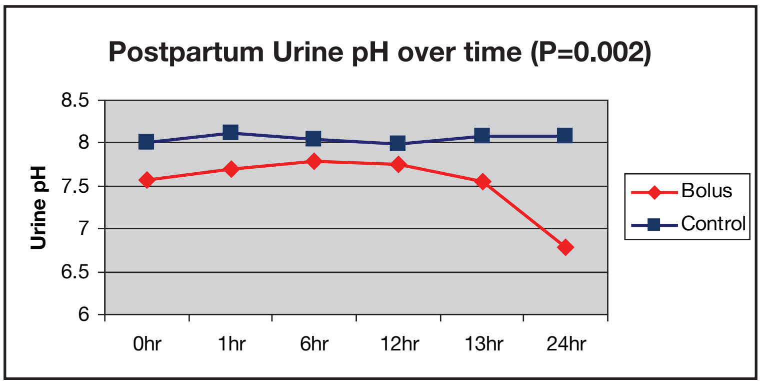
Approximately 50% of the calcium in serum exists as free ionized calcium and ~50% is bound to protein or chelated. Free ionized calcium is the physiologically active form and can provide an accurate assessment of calcium status of the periparturient dairy cow. In this study, ionized calcium (iCa) was not different across groups prior to calving (P=0.72). Hypocalcemia has been defined as iCa <1.00 mmol/L.[3] At calving (0 hr.), the blood iCa had dropped to hypocalcemic levels for the bolus and control cows (0.94 and 0.95 mmol/L respectively). After calving blood iCa was different due to treatments over time (P=0.02). At 24 hours postpartum, blood iCa in the bolus group increased to 1.03 mmol/L while the control group remained unchanged. Total serum calcium levels were not different due to treatments (P=0.41).

Prepartum and 0 hour ionized blood calcium (mmol/L)			
	-48 hours	-24 hours	0 hours
Bolus	1.22	1.18	0.94
Control	1.24	1.19	0.95



Blood pH, Urinary pH, Urinary Ca, and Clinical Assessments

Postpartum blood pH of the bolus and control cows was 7.48 and 7.53 respectively and did not differ due to treatment (P=0.27). However, the bolus was effective at lowering urine pH at 24 hours after calving. Postpartum urine pH was significantly different due to treatment over time (P=0.0027). At 24 hours postpartum, the urine pH of the Bolus group was 6.79 and the Control group was 8.04. Urinary calcium was not different due to treatment (P=0.37). No clinical assessments (appetite, fecal consistency, ataxia, muscle tremors, or rectal temperature) were different due to treatment. Although appetites for both groups were suppressed at calving, the postpartum appetite of the Bolus group steadily increased from calving to 24 hours while the Control group had weaker appetites. Rectal temperature in the control cows numerically decreased from calving to 24 hours after calving.



DISCUSSION

The onset of lactation results in a tremendous demand on available calcium and can rapidly deplete the blood calcium pool. As stated above, several strategies are utilized to help prevent hypocalcemia in the periparturient dairy cow. Supplementing cows with oral calcium is a commonly used strategy. By providing a large dose of soluble calcium, it is possible to force calcium between intestinal epithelial cells by passive diffusion. The BOVIKALC bolus contains 43 grams of calcium in the form of calcium chloride and calcium sulfate. In the present study, hypocalcemic (iCa <1.00mmol/L) cows were either given a BOVIKALC bolus at calving and again 12 hours later, or were given no supplemental calcium. Cows given the BOVIKALC showed an increase in iCa from 1 hour to 24 hours after calving while the controls showed no increase and remained hypocalcemic. Cows given BOVIKALC maintained iCa above 1.0 mmol/L after the initial bolus was administered.

Another commonly used strategy for preventing hypocalcemia is the use of anionic salts in the close-up dry cow diet to reduce the dietary cation-anion difference. However, palatability, uniform intake, and the need for a separate close-up dry cow ration can be a limitation to their use in some herds. The addition of anionic salts can create an acidic diet, a mild metabolic acidosis, and decrease the incidence of milk fever and subclinical hypocalcemia. When feeding anions, urine pH is used to monitor adequate intake and effectiveness. The mild metabolic acidosis created by anionic salts results in a drop in urine pH. In this study, urine pH of the BOVIKALC supplemented cows was 6.79 at 24 hours postpartum versus 8.04 for cows not receiving calcium supplementation. This suggests that calcium chloride and calcium sulfate in the bolus may be effective in lowering the acid-base status of treated cows.

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Printed in the U.S.A.