

Epidemiology of subclinical hypocalcemia in early-lactation Holstein COWS

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Introduction

Hypocalcemia is one of the most common periparturient abnormalities afflicting dairy cows. The disorder is frequently divided into a clinical (i.e., parturient paresis) and a subclinical state, with the latter receiving much recent research attention. For classification purposes, subclinical hypocalcemia (SCH) should be defined as low blood Ca concentrations that are associated with periparturient health disorders, poorer production and reproduction outcomes, or both, without associated signs of postpartum paresis. Our objective was to characterize the epidemiology of SCH in Holstein cows by assessing the temporal associations of plasma Ca concentrations in the first 4 days-in-milk (DIM) with the risk of cows being diagnosed with metritis/and or displaced abomasum in the first 60 DIM and milk production across the first 15 wk of lactation.

Materials and Methods

We conducted a prospective cohort study in 2 dairy herds in New York State in which cows had blood samples collected daily for the first 4 DIM; a total of 389 cows (186 primiparous and 253 multiparous) were enrolled. Multi-variable Poisson regression models were built to evaluate the disease outcomes, and generalized linear mixed models were built to evaluate the milk production outcome. Plasma Ca concentration was assessed in the continuous scale in all models; dichotomization and SCH classification only occurred if the Ca concentration variable was meaningful by creating an optimized threshold based on receiver operating characteristic curve analyses.

Results

Plasma Ca concentration at 1 DIM was not associated with the risk of metritis in primiparous cows ($P=0.22$), but we observed an association at 2, 3, and 4 DIM (critical thresholds were plasma Ca concentration ≤ 2.15 , 2.10, and 2.15 mmol/L, respectively; all $P \leq 0.001$). Primiparous cows with plasma Ca concentrations below these cut points had a higher risk of metritis diagnosis (risk ratios (RR) ranged from 4.0 to 6.1 at 2 and 4 DIM, respectively). Plasma Ca concentration was associated with the risk of metritis and/or displaced abomasum diagnosis for 2nd parity cows at 2 DIM (threshold ≤ 1.97 mmol/L; $P=0.03$; $RR=4.1$) and at 4 DIM for parity ≥ 3 cows (threshold ≤ 2.20 mmol/L; $P=0.03$; $RR=3.1$). Reduced plasma Ca concentration was associated with higher milk production when assessed at 1 DIM in primiparous and multiparous cows (2.9 ± 0.8 kg/d, $P \leq 0.01$), and lower milk production when assessed at 4 DIM in multiparous cows only (-1.8 ± 0.8 kg/d, $P=0.02$). For primiparous cows, plasma Ca concentration was not associated with lower milk production at any of the DIM assessed ($P > 0.30$).

Significance

We conclude that assessment of SCH at the individual cow level must take into account the DIM of Ca concentration measurement and parity of the cow, as the epidemiology of SCH is highly dependent on these variables.