

Blood Calcium and Phosphorus Relationships in the Parturient Paresis Syndrome in Mature Holstein Cows

Luc DesCoteaux¹, DMV, M.Sc., Dipl. ABVP(Dairy)

Randy Krainock², DVM, Kerry Lissemore², DVM, DVSc

¹Departement de Sciences Cliniques, Faculte de Medecine Veterinaire, Universite de Montreal
C.P. 5000, Saint-Hyacinthe, Quebec, Canada, J2S 7C6

²Department of Population Medicine, University of Guelph, Guelph, Ontario, Canada N1G 2W1

An observational study was conducted in 79 mature Holstein cows from 28 dairy farms selected from Ontario Veterinary College, Ruminant Field Service clients that participated in a monthly herd health program. The objectives were to measure and describe the serum levels of calcium and phosphorus, to evaluate the relationships between these two values in the parturient paresis syndrome of dairy cows and to find specific cut-off values to better predict clinical milk fever cows. All eligible third plus lactation cows entered the study if the calving occurred between February 15 and May 15, 1992. All cows were examined within the first 24 hours after parturition by a farm service clinician. A standard questionnaire and physical examination sheet was completed for every cow. At the end of the evaluation, a serum sample was taken from the caudal vein with a vacutainer vial.

Milk fever or parturient paresis, caused by hypocalcemia, generally affects high producing dairy cows in their third or greater lactation. Substantial economic loss to dairy producers results from the treatment of clinical milk fever and a complex of milk fever associated diseases. A syndrome of reduced appetite and poor production in early lactation cows caused by subclinical hypocalcemia may be included in this complex. Early diagnosis, treatment and prevention are therefore required to reduce the cost of milk fever.

A hypocalcemic cow was defined on a critical level as having an ionized calcium (CaF) level below 1.0 mmol/L or a total calcium (TCa) value below 2.0 mmol/L. Based on the clinician's final decision to treat the examined cows, this study had an incidence of clinical milk fever of 41.8% (33/79). If we exclude down cows at the first evaluation, defining a hypocalcemic cow using TCa, this study had a prevalence of 71.6%. Of all those standing cows only 43.8% were considered by the veterinarians as having clinical milk fever. This study demonstrated a higher

incidence rate of clinical milk fever compared to most previous studies because the study population included only cows in their third lactation or greater. In other studies, many authors included all the cows in the herd as the risk population. In addition, every cow in this study was evaluated twice within 48 hours of parturition by a veterinarian. These evaluations gave the opportunity to treat some clinical and subclinical cows that would have been considered normal to most dairy producers and consequently increased the lactational incidence rate of milk fever.

When dividing the subjects into No Clinical Sign (NCS) cows (n=46), Stage I milk fever (n=22) and Stage II/III milk fever (n=11), the total calcium levels (TCa) were 1.91 ± 0.29 , 1.48 ± 0.27 and 1.26 ± 0.29 mmol/L respectively. These data are in agreement with McLennan (1971). The Bonferroni pairwise comparison of means of TCa for these 3 groups showed no significant difference at P-level of 0.05 between the 2 milk fever groups but a significant difference between the NCS cows and the 2 milk fever groups. The overall ionized calcium (CaF) and total calcium (TCa) levels in the serum (0.89 ± 0.13 mmol/L and 1.70 ± 0.38 mmol/L respectively) were similar to other studies. The Pearson's correlation between these calcium values was 0.955 and significant with a P-value < 0.001 . The ionized portion (CaF/TCa) of the total calcium was $52\% \pm 4\%$ and was not different between any milk fever groups. In accordance with other studies, this information suggests that there is little advantage in testing for serum CaF instead of TCa in these cases.

A discriminant analysis was performed to find the TCa serum level that maximized the sensitivity and the specificity to predict cows that will develop clinical milk fever. The threshold level of 1.7 mmol/L gave a test sensitivity, specificity, positive and negative predictive values of 81%, 82%, 77% and 86% respectively. Based on

the discriminant analysis, the TCa threshold level of 1.7 mmol/L minimizes the excess use of calcium salts to treat milk fever cows in this population at risk. The actual reference values for total serum calcium in dairy cows should be revised and a calcium level between 1.6 - 2.1 mmol/L (1.91 ± 0.29 mmol/L) would better describe the postparturient dairy cow population at risk of developing clinical milk fever.

The phosphorus levels between these 3 groups were significantly ($P < 0.05$) different and the TCa/P ratios were significantly different ($P < 0.05$) in down cows compared to standing cows. When dividing the cows into No Clinical Sign (NCS) cows ($n=46$), Stage I milk fever ($n=22$) and Stage II/III milk fever ($n=11$), the phosphorus levels were 1.30 ± 0.46 , 0.88 ± 0.47 and 0.41 ± 0.18 mmol/L respectively. The TCa/P ratios were 1.64 ± 0.62 , 2.07 ± 0.89 and 3.53 ± 1.34 respectively for the NCS, Stage I and Stage II/III milk fever. When using a cut-off point of 2.5 for the TCa/P ratio, as a diagnostic test in the clinical milk fever group, to determine the position of the cows (standing or down), the agreement between these criterias, as determined by the Kappa value, was 0.50 and the other test characteristics were 0.82, 0.73, 0.60, 0.89 respectively for the sensitivity, specificity, positive and negative predictive values. Interestingly, the phosphorus levels and the TCa/P ratios were significantly different in Stage II/III milk fever cows compared to Stage I. Knowing that the TCa levels were not different between the 2 milk fever groups, we can speculate that the serum

phosphorus level can be a potentially predisposing factor for down milk fever. Low serum phosphorus levels have been observed in clinical cases of milk fever and have been credited with an influence on the signs which occur (Radostits *et al.*, 1994). There is experimental evidence described by Daniel and Moodie (1979) to support this finding and it also seems probable that the hypophosphatemia could prolong the duration of recumbency. When using a cut-off point of 2.5 for the TCa/P ratio as a diagnostic test in the clinical milk fever group, it was found that when the cow is standing, the ratio is less than 2.5 in 73% of the cases (specificity) compared to 18% in the down cows (1 - sensitivity). Based on a prevalence of 33% of down cows in the clinical milk fever group, a TCa/P ratio of less than 2.5 predicts that cows should be standing 89% of the time (negative predictive value) compared to 40% of the time when the ratio is over 2.5 (1 - positive predictive value). This test (TCa/P ratio of 2.5) has a fairly good agreement ($\kappa=0.5$) with clinical findings and has the best combined test sensitivity and specificity compared to other calculated ratios in this study.

The role of phosphorus in the parturient paresis syndrome in not well understood. This study speculates that low serum phosphorus levels can be involved in the down cow syndrome and that we should also look at the calcium to phosphorus ratios when evaluating parturient paresis blood chemistry profiles in order to improve the success of the therapy.

Abstract

Neosporosis: Report of the International *Neospora* Workshop

Compendium's Food Animal, Vol 19 (4), April 1997

Neospora caninum is a protozoan parasite that was mistaken for *Toxoplasma gondii* until the mid-1980's. Although it was first identified in dogs, neosporosis has recently been recognized as a major cause of abortion in cattle, particularly dairy cattle, worldwide. The infection can be transmitted vertically over several generations, but how the cows acquired the initial infection is unknown. If horizontal transmission occurs, it is apparently infrequent. At present, veterinarians

can diagnose neosporosis and can document whether neosporosis is contributing to reproductive losses at a dairy. Until the definitive host is identified or a vaccine against the disease is developed, veterinarians can make few specific recommendations for prevention of this disease. There is currently no evidence that neosporosis poses any zoonotic risk. This workshop was made possible by special funds from Bayer AG and Bayer Corporation.