Assessment of L-lactatemia as a predictor of bovine respiratory disease incidence and severity in feedlot steers

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Introduction

Bovine respiratory disease (BRD) is the leading cause of morbidity and death in feedlot cattle. Prognostic tools for the prediction of morbidity and severity of BRD are currently lacking. Blood L-lactate (LAC) is a metabolite that increases because of various conditions including stress and cellular hypoxia, which frequently accompany severe forms of BRD. Results of another study conducted in feedlot cattle indicate that low LAC concentration at processing was associated with a greater risk of developing BRD during the early feeding period. Investigators of other studies in double-muscled calves and in hospital settings have demonstrated that a single measurement LAC can be predictive of death. The objectives of this study were to assess the clinical usefullness of evaluation of LAC concentration at processing as a predictor of BRD during the early feeding period and to assess serial measurement of LAC concentration in feedlot steers with BRD.

Materials and Methods

Two hundred thirty-two mixed-source, auction market-derived steers were purchased in 3 loads and brought to the study site where blood samples were collected at processing for determination of LAC concentration by use of a handheld analyzer (Lactate Pro, Arkray, Kyoto, Japan). In an attempt to control for the effects of steer disposition on LAC measurement, steers were assigned a subjective temperament score ranging from 1 (quiet) to 3 (wild) upon entering the squeeze chute. The blood sample for LAC determination was then obtained by caudal venipuncture prior to the performance of additional processing procedures.

The first 29 steers with BRD, as detected during daily penchecking and based on a rectal temperature > 104°F (40°C), depression, and altered respiratory function, were brought to the chute on days 0, 3, 6, 9, and 15 for determination of LAC concentration. These steers were enrolled in a concurrent trial which did not allow antimicrobial treatment before day 15. Deaths occurring between days 0 and 15 were recorded. A logistic regression analysis, which modeled the odds of morbidity, was performed for the processing data using log LAC, calf temperament, and load as fixed factors (PROC LOGISTIC in SAS) and forcing LAC in the model. Nonparametric analysis (Mann-Whitney test) was used to assess LAC concentration at first pull in survivors and non-survivors. Cox proportional hazard modeling was performed with LAC concentration at different times (day 0 to 15) treated as a time-varying, updated covariate (PROC PHREG in SAS). Values of $P \leq 0.05$ were considered significant.

Results

Of the 232 steers, 87 developed BRD during the early feeding period. When modeling the odds of experiencing BRD using the data collected at processing, log LAC was not significant in the model (odds ratio [OR], 1.325; 95% confidence interval [CI], 0.939 to 1.871; P (Wald test)= 0.11), whereas temperament did have a significant effect (P=0.02). The odds of morbidity were significantly decreased for calves with a temperament score of 2, compared with that of quiet calves with a temperament score of 1 (OR, 0.423; 95% CI, 0.212 to 0.842; P=0.01), but not with that of calves with temperament score of 3 (OR, 0.881; 95% CI, 0.370 to 2.096; P=0.77).

Of the 29 cases that were sequentially analyzed, LAC concentration at the first pull did not differ significantly (P=0.76) between the 17 survivors (median, 2.8 mmol/L; range, 0.8 to 7.8 mmol/L) and 12 non-survivors (median, 2.25mmol/ L; range, 1.6 to 5.4 mmol/L). Results of Cox regression analysis using LAC as an updated covariate indicated that a 1-unit increase in LAC concentration significantly increased hazard of death by 25.6% in calves with BRD (hazard ratio, 1.256; 95% CI, 1.058 to 1.4853). Interestingly, evaluation of a single measurement of LAC concentration was not a good predictor of death in this study.

Significance

The prognostic ability of LAC to predict death was limited in this study, but warrants further investigation in larger trials that also assess other outcomes such as relapses or altered growth.