

Determination of blood cardiac troponin I and L-lactate cut-off values for predicting survival in dairy cows affected by downer cow syndrome

Josiane Labonté, DVM¹; Jocelyn Dubuc, DVM, MSc, DVSc²; Jean-Philippe Roy, DVM, MSc, ECBHM²; Sébastien Buczinski, DVM, DÉS, MSc, DACVIM²

¹Bureau vétérinaire de Richmond, Qc, Canada, J0B 2H0

²Clinique ambulatoire bovine, Faculté de médecine vétérinaire, Université de Montréal, Qc, Canada, H3C 3J7

Introduction

The downer cow syndrome (DCS) is a challenging health issue in the dairy industry because of the high incidence of negative outcome. For practitioners dealing with DCS cases, it implies dealing with the cause of the problem but also with animal welfare concerns. Unfortunately, no cow-side test is available to provide an accurate prognosis of DCS cases in farm settings.

The presence of local and/or systemic hypoperfusion and myocardial lesions can lead to an increase in blood concentrations of biomarkers such as cardiac troponin I (cTnI) and L-lactate.

Since their blood concentrations can be determined using a validated cow-side portable unit, the objective of this study was to determine the cut-off values of these biomarkers for predicting survival in dairy cows affected by DCS.

Materials and Methods

A prospective cohort study was conducted in five veterinary clinics of the Province of Québec, Canada. A total of 220 cows affected by DCS were targeted to be recruited in this study based on the following Inclusion criteria (1) a downer cow that did not rise after a first calcium therapy by a practitioner or (2) a cow obviously down for another reason than hypocalcemia (i.e.: obvious musculoskeletal injury). The practitioner performed a standardized anamnesis and a physical examination procedure. Blood samples were taken for a complete blood chemistry panel, and also to quantify blood cTnI (I-stat analyzer, Abaxis, Union City, CA) and L-lactate (Lactate-Pro, Arkray, Kyoto, Japan) concentrations. Veterinarians were blinded to cTnI and L-lactate results.

A follow-up with dairy producers was done by phone to assess survival of DCS cases 7 days after enrolment. The outcome was considered positive (PO) if the animal was still in the herd and negative (NO) if the animal died, was euthanized, or culled.

cTnI and L-lactate blood values were dichotomized using various cut-off. For each predictor, the value that offered the highest sum of sensitivity and specificity

(Youden index) to predict survival was retained as the best cut-off value. Other variables were brought back to two categories to perform a chi-squared test. The cTnI and L-lactate cut-off values and other variables were tested in a multivariable logistic regression model (PROC GLIMMIX in SAS) accounting for the random effect of farm.

Results

A total of 218 dairy cows were included in this study. Median time spent down was 15 hours (minimum-maximum; 1-168). Median days in milk was 3 (dry-468) and median lactation was 3 (0-10). Median cTnI blood value was 0.4ng/ml (0.0- > 50.0). Median L-lactate blood value was 1.4 mmol/L (< 0.8-15.6). Prevalence of NO in this study was 63%.

The Youden index for cTnI was ≥ 0.7 ng/ml. Using this cut-off as a definition of hypertroponinemia, sensitivity and specificity (95% CI) for predicting NO were 78.4% (67.3-87.1%) and 54.1% (45.3-62.7%), respectively.

The Youden index for L-lactate was 1.0 mmol/L. Using this cut-off as a definition of hyperlactatemia, sensitivity and specificity (95% CI) for predicting NO were 69.1% (60.9-76.3%) and 36.3% (27.6-47.2%), respectively.

Hypertroponinemia was associated ($P = 0.004$) with survival. Since the Youden index of L-lactatemia was close to 100, this predictor was not tested in the model.

Significance

Hypertroponinemia (blood cTnI ≥ 0.7 ng/mL) was associated with prediction of survival in DCS cases and could be used on farms to help veterinarians dealing with such condition. Surprisingly, L-lactatemia was not associated with survival of DCS cases.

The use of cowside blood cTnI concentrations in DCS cases could help to promptly identify cows that would benefit from a more aggressive therapy (referral to a hospital with a flotation tank) or from euthanasia to avoid unnecessary pain and cost.