Utilizing leukocyte differentials at arrival to predict death in feedlot calves

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Introduction

Although 14.8% of US feedlots (39.3% of US feedlots with capacity of 1000 head or more) treated cattle with an injectable antimicrobial at arrival (USDA 2019), respiratory mortality rates have increased (Vogel et al, 2015). Interventions have been suggested to reduce mortality (Booker et al, 2017), but concerns over antibiotic resistance (Catry et al, 2003) have prompted a need for accurate identification of at-risk animals for more targeted application. As leukocyte differentials have been shown to be predictive of respiratory morbidity (Richeson et al, 2013), the objective of this study was to determine the relationship between leukocyte differentials and risk of respiratory mortality in feedlot cattle.

Materials and Methods

A total of 953 high-risk, stockyard-sourced beef heifer calves (502.43 ± 59.9 lb; 228.4 ± 27.2 kg) were enrolled. All animals received a macrolide metaphylactic treatment as part of the arrival processing regimen which included routine vaccination, implant and PI testing. Blood was collected during processing by jugular venipuncture into a 2mL K3EDTA tube while the animal was in the chute. Samples were immediately used to make blood smears using a HEMAPREP blood smearing device and stained with WrightGiemsa. Blood smears were read in duplicate by qualified examiners (400 cells read in total).

Univariate analysis of lot as a potential covariate was evaluated using a chi-squared test for potential inclusion in multivariate analyses thereafter. Leukocyte percentages and relevant ratios were categorized into 2- (high and low, separated at a threshold using Youden's index on the receiver operator characteristic [ROC] curve) and 3-level (lowest quartile, interquartile range, highest quartile) groups. Each categorical covariate was then evaluated independently with multivariate logistic regression to evaluate the association with death within 28 days-on-feed.

Results

Out of the 953 animals, 56 (5.9%) died within 28 d. Lot had a significant effect on respiratory mortality (p=0.0012) and was included in the multivariate models as a fixed effect. The area under the ROC curves were low to moderate for most variables except for lymphocytes (L; 0.7), band neutrophils (B; 0.26), and band-to-segmented neutrophil ratio (BNR; 0.27). For the 2-level categorization, the odds of respiratory mortality were 34% (95% CI: 0.19-0.60) lower for neutrophils (N) < 28%, 29% (95% CI: 0.17-0.52) lower for neutrophil-to-lymphocyte ratios (NLR) < 0.47, 45% (95% CI: 0.26-0.79) lower for monocytes (M) < 7%, 17% (95% CI: 0.10-0.31) lower for B < 1%, and 19% (95% CI: 0.11-0.33) lower for BNR < 0.05% relative to each of their respective groups.

Additionally, the odds of respiratory mortality were 563% (95% CI: 3.06-10.35) higher for L < 61% and 260% (95% CI: 1.47-4.61) higher for eosinophils (E) < 0.38%.

Significance

Blood leukocyte differentials at enrollment were significant predictors of mortality from BRD in high-risk beef heifers receiving metaphylactic treatment at time of arrival with band neutrophils, eosinophils, and lymphocytes being the most significant predictors.