Comparative efficacies of enrofloxacin and tulathromycin for the control of respiratory disease in beef cattle

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Introduction

Bovine respiratory disease (BRD) is the most common cause of morbidity and mortality in North American beef cattle. Antimicrobials are commonly used to prevent BRD in cattle at high-risk of developing BRD, however, recent work would suggest that this practice might be one factor contributing to the increased prevalence of AMR in *Mannheimia haemolytica* (Mh). We hypothesized that the administration of the short-acting fluoroquinolone, enrofloxacin, would be just as effective as the long-acting triamilide, tulathromycin, in preventing BRD but would be less likely to select for AMR Mh in stocker calves at high-risk of developing BRD.

Materials and Methods

At the time of each day's processing, calves were randomly assigned to receive either enrofloxacin (Baytril 100, Bayer Animal Health, Shawnee Mission, KS) at its label dose (7.5 mg/kg SQ once) or tulathromycin (Draxxin, Zoetis Animal Health, Florham Park, NJ) at its label dose (2.5 mg/kg SQ once) to control BRD. Both study personnel and farm staff were blinded to treatments. After metaphylactic antimicrobial administration, cattle were sorted and housed in group pens according to assigned treatment and monitored for the development of signs consistent with BRD for 45 days after processing using visual observation of clinical signs.

Each day that samples were acquired at processing, 8 calves were randomly selected for nasal swab collection using a random number generator application. A second DNP was collected from each calf sampled at arrival processing at the time of revaccination 14 to 17 days later. If any calves that were selected for nasopharyngeal swabs were treated prior to revaccination, then the revaccination sample was collected prior to treatment. Susceptibility of Mh isolated from DNPs to the following antimicrobials was evaluated: ceftiofur; enrofloxacin; florfenicol; gamithromycin; tilmicosin; and tulathromycin. For each antimicrobial agent, isolates were characterized according to guidelines established by the Clinical Laboratory Standards Institute.

A multi-level logistic regression model with random effects for pen and calf was used to evaluate the fixed effects of treatment group, sampling occasion, and the treatment by sampling occasion interaction, on the prevalence of Mh isolated from paired deep nasopharyngeal swabs. Mixed logistic regression models with pen as a random effect were used to compare the treatment groups with respect to the proportions of calves that required at least 1 treatment for BRD, the proportions of calves that required more than 1 treatment for BRD, and the proportions of calves that died within 45 days of arrival. A Cox proportional hazards model with a shared pen frailty was used to compare treatment groups with respect to the time from arrival of calves until their first BRD treatment. All tests assumed a 2-sided alternative hypothesis, and $P < 0.05$ was considered statistically significant.

Results

The odds of being diagnosed with BRD were approximately 58% lower (95% CI: 0.18, 0.96) for calves receiving tulathromycin compared to those receiving enrofloxacin (P=0.040). The odds of requiring a second treatment were approximately 60% lower for calves receiving tulathromycin compared to those receiving enrofloxacin (P=0.107). In addition, 12.2% of calves receiving enrofloxacin died during the 45-day follow-up period, compared to 10.1% of calves receiving tulathromycin (P=0.592). There was a significant effect of sampling time on the proportion of calves carrying MDR isolates, with calves from both groups having a higher prevalence of MDR isolates at revaccination than arrival ($P < 0.001$).

Significance

These results indicate that tulathromycin is superior to enrofloxacin for the control of BRD in calves at high risk of the disease. Shedding of Mh increased between arrival and revaccination, and the proportion of calves shedding MDR Mh increased in both treatment groups. Research evaluating novel non-antimicrobial methods of BRD control should be performed.