

Does a liposomal bupivacaine suspension (Nocita[®]) provide extended pain mitigation when disbudding dairy calves?

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Introduction

The goal of this study was to explore a liposomal bupivacaine suspension product (Nocita[®]) (LB) as a local anesthetic for calf disbudding relative to bupivacaine (B) and a lidocaine control (C). We hypothesized that LB would provide extended pain mitigation relative to B and C.

Materials and methods

Thirty Holstein calves, age 3-5 weeks, were randomly assigned to one of 3 treatment groups (LB, B, C). Anesthesia was confirmed by pinprick tests on each horn bud (HB) at 5-minute intervals for a maximum of 60 minutes. Cautery disbudding was performed once anesthesia was confirmed in both HB or after 60 minutes; disbudding was only performed on HB that were successfully anesthetized. Heart rate (HR), Respiratory rate (RR), plasma for cortisol, mechanical nociceptive thresholds (MNT) and infrared thermography (IRT) were collected over 72 hours for calves with at least one HB disbudded. Pain related behaviors were quantified from video recordings of the home pen using 20-minute continuous sampling prior to treatment through +60.5 hours relative to disbudding.

A survival analyses was used to analyze treatment differences for latency to anesthesia, with results presented as hazard probabilities. Mixed linear models were used to analyze HR, RR, cortisol, IRT, MNT and behavior data. With the exception of HR, models included interaction of time point and treatment, with group as a covariate. The model for HR included the main effects of treatment and time point as the interaction of those 2 main effects was not significant. Calf was included as subject in all models. A Gaussian distribution was used for HR and RR, Gamma distribution used for cortisol, IRT and lying behavior and Poisson distribution for play and rub/scratch behaviors.

Results

Of the 30 total calves (60 HB), 5 calves were not successfully blocked on either HB and 5 were successfully blocked on only one HB. Numerically, more calves were blocked successfully with C (C = 17, B = 15, LB = 13). Latency to block was significantly faster in C than B ($P = 0.01$), but C and B did not differ from LB ($P \geq 0.08$).

Across time points, HR was higher at -1hr relative to disbudding than +1hr for all treatments. HR was lower in B calves relative to C at +3hr ($P = 0.03$). Treatment differences for RR were observed between B and LB ($P = 0.01$), but not across time points. Plasma cortisol concentration did not differ prior to disbudding but was higher for LB than C and B at +0.5h, and for C relative to B and LB at +1hr. There were no obvious patterns across time points within treatment.

There were no consistent patterns across time periods for IRT, although C was significantly lower than B and LB at +6hr and C was significantly lower than LB at +24hr MNT values did not differ from baseline values for LB from +1h to +12h, whereas B did not differ from baseline from T+1 to T+6. MNT for C increased at T+1 but returned to baseline at T+3. Greater reactivity was displayed by C calves at +12h through +72h relative to all previous measurements, whereas greater reactivity was observed for B calves from +9h through +72h and for LB calves at T+24 and +48 through +72 relative to all previous time points.

LB was not associated with reduced frequency of pain related behaviors. Ear flicking and head shaking did not differ between treatments or across time points within treatment ($P = 0.15$). More head rubbing and/or head scratching was displayed by B calves than C at +1hr ($P = 0.01$), and within B, more head rubbing and head scratching was observed at +1hr relative to -0.5, +3.5, +6.5, +24.5 and 48.5hr ($P \leq 0.04$).

Significance

In conclusion, we found evidence that LB provides extended pain mitigation following cautery disbudding based on MNT values through +12h. These findings were not supported with physiologic, endocrine or behavioral responses. Furthermore, fewer calves were successfully anesthetized with LB relative to C and B treatments. Hence, we do not recommend LB for on-farm use in disbudding protocols.

