

Evaluating the efficacy of two local anesthetics to extend analgesia in Holstein calves after dehorning

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Introduction

The dehorning of dairy calves is a painful procedure routinely done in commercial production systems, to facilitate handling and increase human and animal safety. The American Association of Bovine Practitioners recommends the use of procedures and practices that reduce or eliminate pain associated with dehorning to improve on-farm animal welfare. This study aimed to 1) determine if the addition of bupivacaine liposome injectable suspension or ethanol to lidocaine would provide extended pain relief to dairy calves post-dehorning, and 2) determine which local anesthetic most effectively reduced pain biomarkers and behaviors post-dehorning.

Materials and methods

Thirty-two Holstein bulls and heifers (approximately 5 months old) were enrolled and randomly assigned to one of four treatment groups (n = 8 calves/group): lidocaine cornual block + ethanol local block of the horn buds (ETH); lidocaine cornual block + bupivacaine local block of the horn buds (BUP); lidocaine cornual block + lidocaine local block of the horn buds (LID); lidocaine cornual block + lidocaine local block of the horn buds + oral meloxicam (LID + MEL; "gold standard"). Calves were administered their treatment 10 min pre-procedure, and then scoop dehorned followed by horn tissue cauterization. Outcome variables were collected at baseline, and at 0, 0.5, 1, 2, 4, 8, 24, 48 and 72h post-dehorning. Measures included mechanical nociception threshold (MNT), infrared thermography (IRT), visual analog scale (VAS) scoring, and blood sampling for serum cortisol and prostaglandin E2 metabolites (PGEM).

Results

Treatment x time interactions were found for MNT, cortisol and PGEM. MNT values decreased from baseline (i.e., increased pain sensitivity around the horn buds) beginning at 8 h post-procedure for BUP ($P < 0.01$), 24 h post-procedure for ETH and LID + MEL ($P < 0.01$ for both), and 48 h post-procedure for LID ($P < 0.04$). At 2 h post-dehorning, BUP had higher cortisol levels (17.32 ng/mL) relative to LID + MEL (3.10 ng/mL; $P = 0.03$). At 4 h post-dehorning, LID + MEL had lower PGEM (10.23 pg/mL) compared to ETH (27.08 pg/mL; $P = 0.03$). At 8 h, LID + MEL had lower PGEM (9.12 pg/mL) compared to ETH and BUP (24.80 and 20.52 pg/mL, respectively; $P < 0.03$). There was evidence of a sex effect for MNT, with bulls demonstrating a higher threshold (13.74 kgf) compared with heifers (12.12 kgf; $P = 0.04$). There was also a sex effect for cortisol, with bulls having a lower mean cortisol (6.96 ng/mL) compared with heifers (13.88 ng/mL). No treatment effects were found for MNT, VAS or IRT.

Significance

Neither bupivacaine liposome suspension nor ethanol were able to significantly extend the duration of analgesia beyond the currently recommended multimodal approach (local anesthesia and systemic analgesia). Female animals had a more pronounced pain response, with higher cortisol levels and lower nociceptive thresholds compared to males, suggesting pain management protocols may need to be adjusted based on sex. Future work should assess BUP and ETH's ability to manage pain in a more industry-relevant disbudding model.

