Comparison of analgesics for control of lameness-associated pain in lactating dairy cattle

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Introduction

Economic losses and welfare implications of lameness vastly impact the dairy industry. There is a need for effective modalities of analgesia to minimize welfare concerns regarding lameness associated pain in lactating dairy cattle. Non-steroidal anti-inflammatory drugs (NSAIDs), like meloxicam and flunixin meglumine, are commonly used by veterinarians for pain control. Data is limited as to their efficacy in lameness associated pain management (Coetzee et al, 2017). The overarching goal of this study was to compare the analgesic effects of flunixin meglumine (IV) and meloxicam (PO) in lactating dairy cattle following experimentally induced lameness via intra-articular injection of amphotericin B. We hypothesized that lameness would improve under meloxicam treatment compared to flunixin meglumine or no treatment control. The impact of determining a NSAID therapeutic treatment for lameness is necessary in combatting welfare concerns in the dairy industry.

Materials and Methods

Forty-eight lactating Holstein cows, determined to be healthy and free from lameness, were enrolled and randomly allocated to 1 of 4 treatment groups. Four treatment groups were utilized: lameness + flunixin meglumine (FLU), lameness + meloxicam (MEL), lameness + placebo (positive control - PC), sham + placebo (negative control - NC). Mild, transient lameness was induced in FLU, MEL, and PC treatment groups through a 20 mg injection of amphotericin B into the left hind lateral distal interphalangeal joint . The NC treatment group underwent intra-articular injection of 4 mL of sterile water. Blinded drug administration was implemented for all trial personnel responsible for data collection. Flunixin meglumine administration was 1.0 mg/lb (2.2 mg/kg) intravascular every 24 hours for 2 treatments. Meloxicam administration was 0.45 mg/lb (1 mg/kg) orally every 24 hours for 2 treatments. Placebo groups received intravenous saline (2 mL/100 lb [45 kg]) and whey protein in a gelatin capsule (1 capsule/time point). In addition, animals in the FLU group received 2 treatments of 1 gelatin containing whey protein powder and the MEL group received 2 IV administrations of sterile water (2 mL/100 lb [45 kg]). The parameters used to assess efficacy of lameness reduction were pressure algometry (MNT), pressure mat analysis, gait and lameness score, infrared thermography imaging (IRT), plasma substance P concentrations, and plasma cortisol concentrations. Plasma drug concentrations were assessed using liquid chromatography and mass spectrometry. Baseline samples and efficacy parameters were evaluated at -24 hours before first drug administration and then at 0, 2, 8, 24, 72, 96, and 120 hours following treatment.

Results

Results indicate a significant treatment x time effect for maximum MNT (P=0.0217) and maximum IRT of left hind limb (P=0.0033) between treatments. This was also significant in the IRT LH-RH difference (P=0.0031) and plasma cortisol concentrations (P=0.0008). Significant mean treatment effects were seen in MNT of the LH (P=0.0019) and LH-RH difference (P<0.0001). There were also significant mean treatment effects seen of IRT LH (P=0.0297) and IRT LH-RH difference (P<0.0001). Visual lameness scores indicated a significant (P<0.05) difference in FLU relative to MEL at the 2 hour time point. All other parameters displayed no statistical difference between FLU and MEL.

Significance

Results of this study indicated that in cases of mild transient lameness, analgesic treatment (MEL, FLU) provided improved lameness control compared to no treatment (PC). In cases of mild transient lameness, MEL proved to be an effective alternative to FLU. Flunixin meglumine was statistically more advantageous to meloxicam at the two hour time point for gait and lameness score (P<0.05). This is likely due to the fact that FLU underwent intravascular administration versus extravascular administration with MEL. Further research investigating flunixin meglumine and meloxicam in a clinical setting are needed.