

in plasma was approximately three hours (1.3-2.3 hours, mean 1.80 ± 0.50). Calculating for safety, the withdrawal time as 10 times of the $t_{1/2}$, the meat withdrawal time will be recommended as 30 hours or two days. The last detectable ketamine concentration in milk was 51 hours (41.1-50.9 hours, mean 46 ± 4.90). Therefore, approximately 72 hours, or a milk withdrawal time of three days, is recommended.

Lidocaine administered for inverted-L nerve blocks using a volume of 100 mls was detected in plasma from 0.083 to 9.9 hours and 0.5 to 48.7 hours in milk. The longest $t_{1/2}$ of lidocaine in the plasma was approximately six hours (2.5-5.88 hours, mean 4.19 ± 1.69). Calculating for safety, the withdrawal time as 10 times of the $t_{1/2}$, the meat withdrawal time will be recommended as 60 hours or three days. The last detectable

lidocaine concentration in milk was 49 hours (16.3-48.7 hours, mean 32.5 ± 16.2). Therefore, approximately 72 hours, or a milk withdrawal time of three days, is recommended.

There was no detectible lidocaine concentration in the milk or plasma samples following caudal epidural administration at a dose of 0.22mg/kg. Therefore, this technique may be performed without the potential for meat or milk contamination.

Based on the results of this study, to include any residue left below the detectable tolerance of the assay, the recommendations of meat and milk withdrawal times for ketamine and lidocaine support the zero tolerance for meat and milk residues as regulated by the FDA.

The Efficacy of Meloxicam as an Adjunct Therapy in the Treatment of Neonatal Calf Diarrhea Complex

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Introduction

Neonatal calf diarrhea complex has a significant impact on the dairy industry. The National Animal Health Monitoring System reports that diarrhea accounts for greater than 60% of pre-weaned calf deaths. A recent field study in Europe has identified beneficial effects of Meloxicam therapy in calves with diarrhea. This controlled trial examined the efficacy of Meloxicam administration in combination with oral electrolyte and antibiotic therapy for the treatment of calf diarrhea. Compared to control animals, the Meloxicam-treated calves experienced significant improvements in clinical parameters, such as hydration status, fecal consistency, rectal temperature and signs of visceral pain. Overall, calf recovery from the episode of diarrhea was improved for calves receiving Meloxicam therapy, compared to placebo-treated calves. The objective of the current

study was to examine the effects of Meloxicam administration on calf health, behavior and performance in calves with neonatal calf diarrhea complex in Ontario.

Materials and Methods

A double-blind, controlled trial was designed to study Meloxicam administration as an adjunct therapy in the treatment of diarrhea in neonatal dairy calves. Holstein bull calves were purchased at birth from three commercial dairy operations in eastern Ontario and moved to the calf research facility at Kemptville College, University of Guelph. For the duration of the trial, the calves were housed in individual hutches and managed under conditions representative for Ontario. At the onset of diarrhea, the experimental calves were enrolled on the study and randomly assigned to receive a single subcutaneous injection (0.5 mg/kg BW) of

Meloxicam or an equal volume of placebo solution, in addition to the standard therapeutic protocol involving oral electrolyte treatment.

After enrollment, each experimental calf was studied intensively for five consecutive days. During this period, rectal temperature and hydration status, as well as blood gas and electrolyte analysis on days 0, 1 and 2, were determined. In addition, each calf was fitted with a digital pedometer to measure calf activity, and both appetite and feeding behavior observations were collected. Standing posture and resting position were also monitored as calf behavioral outcomes. Total days of oral electrolyte therapy, and any additional therapeutics needed, were recorded. In addition, milk intake, starter intake, water intake and fecal scores were determined daily for all experimental calves until 56 days of age. Weaning was carried out based upon consumption of 1.65 lb (0.75 kg) per day of calf starter for three consecutive days. As such, days to weaning was also an important outcome variable. Preliminary descriptive statistical analysis has been completed for the behavioral, physiological and performance outcome parameters. Analysis of the digital images for behavioral assessment and multivariable mixed-model analysis have not been completed.

Results

Of the 62 neonatal Holstein bull calves purchased, one calf died before enrollment and 56 calves developed diarrhea. The average age for onset of diarrhea was nine and 10 days for the placebo-treated and Meloxicam-treated calves, respectively. Calves in the placebo treatment group tended to require oral electrolyte supplementation for a longer duration of time compared

to the Meloxicam calves. On average, calves of both treatment groups were slightly dehydrated at enrollment. However, a larger percentage of Meloxicam-treated calves were able to rehydrate themselves by the end of the observation period. Average rectal temperature for the experimental calves was slightly elevated for the duration of follow-up, but overall, the two treatment groups were not different. Monitoring of calf activity revealed that the Meloxicam-treated calves tended to be more sedentary for the first two days following the onset of diarrhea and then became considerably more active during the remainder of the observation period. Daily feed and water intakes until 56 days of age demonstrated that the Meloxicam-treated calves consumed more starter and water than the control animals. Average body-weight gain over the study period for the Meloxicam-treated calves was greater than the placebo-treated calves. Since weaning was based on starter intake, the experimental calves that received Meloxicam were weaned, on average, four days earlier than placebo-treated calves.

Significance

Calves with neonatal calf diarrhea complex that were treated with Meloxicam had improved recovery from the effects of the episode of diarrhea over placebo-treated calves, as evidenced by the need for less electrolyte therapy, improved hydration, increased activity and improved intake of calf starter and water. Furthermore, Meloxicam-treated calves were weaned earlier. These results are evidence of improved calf well-being following an episode of calf diarrhea with this non-steroidal, anti-inflammatory therapy.