Apparent Differences in Xylazine, Ketamine, and Butorphanol Pharmacokinetics Linked with Pain Associated with Dehorning and Castration

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Introduction

Management of pain following dehorning and castration is a significant challenge for veterinarians. Physiological effects such as peripheral vasoconstriction and increased heart rate are associated with pain and distress. These effects may alter the pharmacokinetics of parenterally administered sedative-analgesics.

Materials and Methods

Twenty male Holstein calves were randomly assigned to one of two treatment groups: 1) intramuscular xylazine (0.05 mg/ kg), ketamine (0.1 mg/kg) and butorphanol (0.025 mg/kg) and 2) the same treatments with sodium salicylate in the drinking water at 10 mg/mL. In Period 1, calves received sedative-analgesia and were blood sampled at 5, 10, 20, 30, 40, 50, 60, 120, 180, 240, 360, 480, 600, and 720 minutes thereafter. In Period 2 calves received the same treatments immediately prior to surgical castration with a scalpel and dehorning with a Barnes dehorner followed by the same blood sampling schedule. Plasma drug concentrations were determined by validated liquid chromatography-mass spectrometry and subjected to non-compartmental pharmacokinetic analysis. Period 1 and 2 were compared using a Mixed Effects Model with animal nested in treatment designated as a random effect and treatment group, period and period*treatment as fixed effects.

Results

There was no difference in the pharmacokinetic parameters between treatments. However, the time to maximum plasma concentration (Tmax) was shorter for ketamine and butorphanol in Period 2. Furthermore, peak xylazine and butorphanol concentrations (Cmax) were significantly higher in Period 2.

Significance

These findings suggest that the rate of sedative-analgesic drug absorption following intramuscular administration is increased in calves following dehorning and castration.