

# Evaluation of oxygenation, ventilation, and bloating in alfaxalone anesthetized calves

L. Stoffregen, DVM; N. Caulkett, DVM, MVetSc, DACVAA; J. Pearson, DVM, DACT, PhD, BSc; C. Windeyer, DVM, DVSc, BSc

Faculty of Veterinary Medicine, University of Calgary, Calgary, Alberta, T3R 1J3, Canada

## Introduction

Calves commonly undergo abdominal surgery for gastrointestinal and umbilical disease and are typically positioned in dorsal recumbency for the procedure. This poses a high risk for hypoxemia, hypoventilation, bloat and regurgitation. Though these risks are understood, reference values for parameters of oxygenation, ventilation and bloating under anesthesia have not been reported. Alfaxalone is a neuroactive steroid with limited cardiovascular effects that is used in companion animal practice for induction and maintenance of general anesthesia. Though its use in food animals is limited, alfaxalone has been used successfully in sheep and could be used safely in cattle. Demonstrating the safety and efficacy of alfaxalone in calves would promote its viability in food animal medicine. The objectives of this study were to demonstrate a novel anesthetic protocol using a constant rate infusion (CRI) of alfaxalone and to report the cardiopulmonary and blood gas parameters of calves anesthetized in dorsal recumbency with unprotected airways.

## Materials and methods

Seven Holstein bull calves, age 1 week to 1 month, were anesthetized in dorsal recumbency with unprotected airways for 60 minutes while cardiopulmonary and blood gas parameters were measured every 5 or 10 minutes. The following anesthetic protocol was used: premedication with intramuscular (IM) alfaxalone (3 mg/kg) and xylazine (0.2 mg/kg), sacrococcygeal epidural block consisting of 2% lidocaine (0.15 ml/kg) and xylazine (0.05 mg/kg), induction of general anesthesia using intravenous (IV) alfaxalone to effect (0.25-0.5 mg/kg), and maintenance of general anesthesia using an IV CRI of alfaxalone (50-80 ug/kg/min) adjusted to maintain a light plane of anesthesia. Oxygen saturation (SpO<sub>2</sub>) was measured using pulse oximetry. Minute ventilation was measured using a respirometer. Blood pressure monitoring via an arterial catheter was used to measure systolic, diastolic and mean arterial pressures (SAP, DAP, MAP). To assess the efficacy of epidural analgesia, a nerve stimulator was placed on the umbilicus to provide local electrical stimulation. The degree of abdominal bloating was recorded using a bloat score (0 to 3) and a tape measure to measure abdominal circumference. Arterial pressure of oxygen (PaO<sub>2</sub>), arterial pressure of carbon dioxide (PaCO<sub>2</sub>), pH, and bicarbonate were measured from serial samples of arterial blood. All calves began anesthesia breathing room air. If SpO<sub>2</sub> was below 85% after 30 minutes of anesthesia, oxygen was supplemented intranasally at 3 L/min. For all parameters, a one-way ANOVA with repeated measures and Dunnett's multiple comparisons were performed to compare mean values at each measurement times.

## Results

Average baseline SpO<sub>2</sub> and PaO<sub>2</sub> were 75.4% (SD = 6.02) and 44.3 mmHg (SD = 3.20), respectively. For all time points after oxygen was supplemented, SpO<sub>2</sub> ( $P < 0.01$ ) and PaO<sub>2</sub> ( $P < 0.03$ ) were significantly higher than baseline. Average SAP, DAP and MAP increased over time ( $P < 0.05$ ). Hypoventilation was evident throughout anesthesia with an average baseline minute ventilation of 268.5 ml/kg/min (SD = 0.044) and an average final minute ventilation of 250.0 ml/kg/min (SD = 31.3). There was no significant change in abdominal circumference over time ( $P = 0.2$ ); however, there was a significant increase in bloat score over time ( $P = 0.03$ ).

## Significance

The novel anesthetic protocol using a CRI of alfaxalone was effective in maintaining an adequate plane of anesthesia; however, hypoxemia and hypoventilation were evident as expected for calves anesthetized in dorsal recumbency. Blood pressure improved with supplementation of oxygen alongside parameters of oxygenation. There is no evident mechanism of action to explain this relationship, so further investigation into the effects of oxygen supplementation in calves is warranted. Reporting the cardiopulmonary and blood gas parameters observed in this study illustrates the hypoxemia and hypoventilation that young calves experience during anesthesia in dorsal recumbency.

